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NUCLEAR SCIENCE ABSTRACTS

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NUCLEAR SCIENCE ABSTRACTS

Volume 14 Number 2 January 31, 1960

GENERAL AND MISCELLANEOUS

1179 AECU-4441
Goodyear Tire and Rubber Co., Akron, Ohio.
ISOTOPIC METHOD FOR AGE DETERMINATION OF INDUSTRIAL PRODUCTS. Quarterly Progress Report, July—September 1959. T. C Gregson and S. W. Waisbrot. 30p. Contract AT(11-1)-719. OTS.

The materials and methods used for the long-term nuclide pairs are essentially the same as those previously described. (April—June Report). The split planchet method was used to determine the resolving time of the tracerlab superscalar counting apparatus which is currently in use. A planchet was split in two and a sample of nuclide placed in each half and counted. From these results a formula for calculating true counting rates was evolved. Data on resolving time loss for the Superscalar are tabulated. Transmission values of $Sr^{89}-C^{14}$ mixture were measured to determine the degree to which error in these values can be reduced by long counting periods. Data on P^{32} and C^{14} tagged rubber age counts are tabulated. Also, rubber samples were prepared by adding Ca^{45}, Cl^{36}, Nb^{95}, and Tc^{99}, mixing and vulcanizing and isotope pairs ($Ca^{45}-Cl^{36}$ and $Nb^{99}-Tc^{99}$) were similarly incorporated in other samples. Ground and suspended samples of these preparations were age counted. The results obtained by incorporating radioisotopes into rubber did not show close correlation between observed and calculated time. Probable reasons for errors and inconsistencies are discussed along with plans for future work. (J.R.D.)

1180 CEX-58.2
Rochester, N. Y. Univ. Atomic Energy Project.
THE SCATTERING OF THERMAL RADIATION INTO OPEN UNDERGROUND SHELTERS. T. P. Davis, N. D. Miller, T. S. Ely, J. A. Basso, and H. E. Pearse. May 1959. 24p. OTS.

Animals placed in open underground shelters at the Nevada Test Site during an atomic weapon test suffered skin burns of an unknown origin. From a study of the burns it was concluded that the causative agent entered the shelter from outside. the causative agent was subject to rectilinear propagation near the entrance. and the causative agent required a relatively unobstructed opening to effect entrance. The two most likely agents for such burns are hot winds and/or hot wind-borne dust that are forced into the shelter as the shock front from the weapon passes the shelter entrances and radiant energy from the fireball that is scattered into the shelter. A study was made to evaluate the contribution made by radiant energy and, if this contribution proved to be significant, to suggest means of eliminating it. Extensive measurements were made in the laboratory on a scale model of the shelter and direct measurements were made on an actual shelter to ensure the validity of the laboratory results. A Photronic cell and a MacBeth Illuminometer were used to measure the entryway transmission of total radiant energy. The consistency of the results with extended and point sources for the model shelter and the agreement of these results with those from a point source and sunlight for the underground shelter at the Nevada Test Site lead to considerable confidence in the ability to predict the amount of radiant energy that would reach the animals from a weapon of known size. The energy calculated on the basis of these static measurements is about $^1/_{200}$ of that required to produce the burns. Although transient effects caused by the rapid heating of the entryway walls could have resulted in a considerable increase in the entryway transmission, it is felt that radiant energy was neither the sole causative agent nor the most important causative agent in producing burns within the shelters. Hot winds and/or hot wind-borne dust are now considered to be the most likely agents. (auth)

1181 HW-62362
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
UNCLASSIFIED RESEARCH AND DEVELOPMENT PROGRAMS EXECUTED FOR THE DIVISION OF REACTOR DEVELOPMENT AND THE DIVISION OF RESEARCH, SEPTEMBER 1959. L. H. McEwen, comp. Oct. 10, 1959. 42p. Contract AT(45-1)-1350. OTS.

Reactor research and development are summarized under the following programs: plutonium recycle, basic swelling, gas cooled power reactor, maritime gas cooled reactor, nondestructive fuel testing, fixation of radioactive wastes, and radiation effects on metals. (W.D.M.)

1182 MND-SR-1674
Martin Co. Nuclear Div., Baltimore.
STRONTIUM 90 POWER PROJECT. Quarterly Progress Report III covering period April 15, 1959 through July 15, 1959. July 1959. 79p. Contract AT(30-1)-2220, Task II. OTS.

As a result of information received from ORNL, early strontium titanate heat elements may contain macro quantities of stable Ca and Ba. Since these contaminants could affect the solubility of strontium titanate to the detriment of safe containment, test heat elements were prepared containing varying amounts of these elements. In addition to solubility measurements in fresh and sea water, samples are being examined to determine the physical properties of this new mixture. The ceramic investigation showed that heat elements made from pure strontium titanate would be superior to any cermet of that compound. Metal additions below 30 wt. % had no effect on thermal conductivity and did, in some cases, increase the solubility of the heat element by forming soluble complex compounds with the otherwise insoluble strontium titanate. The process for fabricating strontium titanate heat element increments was refined to produce uniform pellets of optimal density, homogeneity, and Sr tie up. To assure future availability of pure Sr^{90} in kilocurie quantities, the separation of this waste fission product is under laboratory scale investigation by ion exchange. Data compiled on the physical and chemical properties of strontium titanate are completed. Results indicate that this choice of heat element compound will possess those properties required for the safe utilization of a Sr^{90} heat source. The thermal conductivity of this compound decreases only slightly with increased temperature, thereby assuring a generator core that will not melt on accidental temperature excursion. The solubility of strontium titanate in fresh and sea water was measured over a period of 100 days. At the end of this time there was absolutely no strontium detectable in the fresh water and only 10 ppb in the sea water. Such information indicates that unclad strontium titanate heat elements would require centuries to dissolve, during which time natural radioactive decay would have reduced kilocurie quantities of Sr^{90} to the millicurie level. A modified sea design with a removable biological shield will make possible the use of this power supply in marine environments where weight is a critical factor. This unit will employ less Sr^{90} with longer thermocouples. The operational shell will be of sufficient thickness to be resistant to deep sea pressure. During storage, it will be encased in a second nickel shield with a liquid metal film between to act as a heat transfer agent. It is anticipated that both sea application devices will operate at approximately seven percent efficiency. Hazards evaluation of the land-based application is in progress. Both structural and radiation integrity are being evaluated. Data obtained during the experimental phases have been interpreted to determine the resistance of a Sr^{90} generator to natural and man-made disasters. (For preceding period see MND-SR-1673.) (auth)

1183 NM-62-04-00.04.01
Naval Medical Research Inst., Bethesda, Md.
SEA WATER RADIOLOGICAL MONITORING METHODS. J. W. Duckworth, F. W. Chambers, Jr., W. H. Chapman, and R. E. Severance. Dec. 17, 1958. 54p. OTS.

The dispersal in time and sea of radioactive contamination produced by a deep underwater atomic blast was studied. Instrumentation methods obtained radiation intensity vs. depth information for several surface locations, and continuously monitored a sea-water intake line aboard ship. Surface contamination measurements were also made. (auth)

1184 SB-400
Office of Technical Services, Washington, D. C.
PLASTICS—POLYMER RESEARCH. (Five Year Bibliography). Oct. 1959. 27p. OTS.

1185 TID-3046(Suppl. 2)
Office of Isotopes Development. Isotope Technology Branch, AEC.
RADIATION APPLICATIONS AND FISSION PRODUCT UTILIZATION. A Bibliography of Selected Unclassified Literature. Gifford A. Young, comp. Jan. 1959. 187p. OTS.

The potential value of high-intensity nuclear radiation in chemical processing, in sterilization of foods and medical supplies, and as a unique energy source has continued to excite interest in development of practical applications and in production of high-energy gamma and beta irradiators. Numerous private industrial firms have initiated research programs to explore the potentialities of industrial radiation. The U. S. Atomic Energy Commission, keenly aware of the many technological and economic problems that must be solved before the full potential of nuclear radiation becomes a practical reality, is supporting basic and applied research on radiation phenomena, conducting programs of fission product separation and radiation source production, and surveying world technology and economic aspects of industrial applications. The U. S. Army Quartermaster Corps is continuing its active programs in radiation preservation of foods. The commercial appearance of several radiation-produced industrial products such as crosslinked polyethylene, permeaselective ion exchange membranes, and bondable and dye-accepting fluorocarbon plastics has lent encouragement to hopes for successful accomplishment of many radiation development program aims. Unclassified reports and published articles of interest to programs for practical utilization of fission products and high-intensity radiation which have appeared in Nuclear Science Abstracts from June 1, 1955, to December 31, 1958, are annotated in this bibliography. Pertinent individual papers presented at the 1955 Geneva Conference on the Peaceful Uses of Atomic Energy also have been included since these were not annotated individually in NSA. This supplement continues the bibliographic control of information originating in the Atomic Energy Commission and elsewhere on radiosterilization, radiation-induced chemical reactions, other uses of high-intensity radiation, and preparation and use of radiation sources begun by the preceding publications in this series, TID-3046 and TID-3046(Suppl. 1). 1360 references. (auth)

1186 UCRL-5542(Rev.)
California. Univ., Livermore. Lawrence Radiation Lab.
PROPERTIES OF THE ENVIRONMENT OF UNDERGROUND NUCLEAR DETONATIONS AT THE NEVADA TEST SITE, RAINIER EVENT. Stanley E. Warner and Charles E. Violet. Apr. 1959. 128p. Contract W-7405-eng-48. OTS.

Results of past studies of the Rainier burst environment are presented. Further interpretations of the nuclear test are not included. Measurements are divided into categories listed as in situ measurements, and measurements on removed samples; transient phenomena were excluded as well as radiochemical information. Where standards of experimental procedures were followed, reference to these standards are made with the property listing. In other cases, available information on test or measurement procedures are included with the listing of the particular property or appended at the end of the report. (J.R.D.)

1187 UCRL-5626
California. Univ., Livermore. Lawrence Radiation Lab.
UNDERGROUND NUCLEAR DETONATIONS. G. W. Johnson, G. H. Higgins, and C. E. Violet. July 8, 1959. 44p. Contract W-7405-eng-48. OTS.

Since 1952 eight nuclear explosions have been fired underground at the Atomic Energy Commission's Nevada Test Site. The explosions have varied in energy release from 55 tons to 19,000 tons of TNT equivalent and were carried out at depths varying from shallow burial to produce cratering to those depths at which no visible effects appeared on the surface. The major experimental data from these explosions, as well as the phenomenology of the deeper shots, are summarized here. (auth)

1188 UCRL-8867
California. Univ., Berkeley. Lawrence Radiation Lab.
CHEMISTRY DIVISION SEMIANNUAL REPORT [FOR] DECEMBER 1958 THROUGH MAY 1959. 88p. Contract W-7405-eng-48. OTS.

Nuclear Chemistry. Preliminary investigations of heavy-ion-induced reactions, Al + C^{12}, have resulted in the identification of protons, deuterons, tritons, and alpha particles among reaction products. Preliminary measurements were made of the energy spectra and angular distributions of deuterons and tritons from the nuclear reactions $C^{12}(\alpha,d)N^{14}$ and $F^{19}(\alpha,t)Ne^{20}$. Photographic-emulsions techniques were utilized to study fission cross sections and angular distributions in the nitrogen-ion bombardment of the separated isotopes, Re^{185} and Re^{187}. Independent yields for five isotopes and cumulative yields for three were measured for iodine isotopes produced in the fission of gold with 120-Mev carbon ions. The fission induced by heavy ions by means of direct counting of the fission fragments in a gas scintillation chamber is being investigated. A mass-spectrometric study of charged-particle fission of U is reported. The nuclear alignment of Tb^{160} and Ce^{137m} was studied. In order to investigate the systematic behavior of excited nuclear levels in even-even nuclei near closed shells, the β-decay schemes of Sb^{126}, Sb^{128}, and Sb^{130}, and their isomers were studied. The number of α particles emitted per disintegration was determined ~ for several astatine and Po isotopes produced in carbon-ion bombardment of gold. A theory of α decay was applied to calculate the reduced α widths of all Po isotopes and the even-odd At isotopes. A program to study semiconductor devices as particle detectors was initiated. Experiments were continued on the preparation of submilligram quantities of Am, Cm, americium nitride, and americium monoxide. The separation of Pa from its daughters Ra, Th, Bi, Rn, and Po by ion exchange is being studied. Crystals of $RbUO_2(NO_3)_3$ more than 1 cm in diameter and containing ~4 μg of Pu^{238} as PuO_2^{2+} were grown. The chlorine of nuclear quadrupole resonance of $ThCl_4$ was found and its frequency measured at several temperatures. General Chemistry. Investigation of chloride complexes of Ru^{3+} is being continued. The study of the preparation of stibine, by the reaction of aqueous borohydride with Sb^{3+}, was completed. The decomposition of Mg and Ca hydroxides was studied by differential thermal analysis. Chemical Engineering. The separation of crystalline organic materials by zone melting is described. (For preceding period see UCRL-8618.) (W.L.H.)

1189

CORRELATION BETWEEN SAMPLE MEANS AND SAMPLE RANGES. Bernard Ostle and George P. Steck (Sandia Corp., Albuquerque, N. Mex.). J. Am. Statist. Assoc. 54, 465-71(1959) June.

The correlation between the mean and the range is investigated for sampling from symmetric and asymmetric populations. It is shown that when the sampling is from any symmetric population with finite variance the correlation is zero. However, zero correlation does not imply symmetry. It is proved that symmetry of the parent population implies that the sample range and midrange are uncorrelated. (auth)

1190

EFFECT OF ATOMIC TESTS ON RADIO NOISE. C. A. Samson (National Bureau of Standards, Boulder, Colo.). Nature 184, Suppl. No. 8, 538-9(1959) Aug. 15.

Two high-altitude atomic explosions which were set off over Johnston Island in the Pacific in August 1958 appear to have had a rather pronounced effect on the radio noise as recorded at Kekaha, Hawaii. Atmospheric radio-noise received for a period before and after the first explosion is shown. In the hour following the blast the noise decreased by as much as 32 db. at a time of day when it would normally be rising or holding steady. Recovery apparently occurred in a matter of hours at 13 kc/s. and 5 Mc/s., but from 51 kc/s. to 2.5Mc/s. a changed pattern was evident for several days with levels at night much below normal. (W.D.M.)

1191

UNITED STATES AT GENEVA, 1958. 2nd. INTERNATIONAL CONFERENCE ON THE PEACEFUL USES OF ATOMIC ENERGY. A Report by the United States Delegation to the Second United Nation International Conference on the Peaceful Uses of Atomic Energy, Geneva, Switzerland, September 1-13, 1958. Washington, D. C., U. S. Atomic Energy Commission, 1959. 194p.

The Second United Nations International Conference on the Peaceful Uses of Atomic Energy was held in Geneva, Switzerland, on September 1 to 13, 1958. Highlights of the Conference are summarized. General sessions on broad aspects of atomic energy covered the future of nuclear power; experience with nuclear powerplants; the possibility of controlled fusion; operational experience in health and safety; the use of isotopes; other uses of nuclear energy; plans for nuclear powerplants; fundamental physics; the supply and training of personnel; and international collaboration. Scientific sessions were held on physics; reactors; chemistry; isotopes and biology; and raw materials, metallurgy, and reactor technology. A pictorial report on the United States exhibit, with a description of each exhibit, is included. Appended are a list of the nations and international agencies participating in the Conference; a list of the 557 members of the United States delegation, abstracts of papers presented orally by United States delegates at technical sessions; a list of contributors to the technical exhibit; a list of United States films shown during the Conference; and a list of United States publications distributed at the Conference, 47 photographs. (C.H.)

1192

EXPLOSIONS, DETONATIONS, FLAMMABILITY AND IGNITION. PART I. SELECTED ANALYTICAL STUDIES ON EXPLOSIONS, DETONATIONS, FLAMMABILITY LIMITS, AND IGNITION OF GASES, AND ON HETEROGENEOUS BURNING. S. S. Penner. PART II. EXPERIMENTAL AND THEORETICAL STUDIES OF FLAMMABILITY, IGNITIBILITY AND EXPLOSION PREVENTION. B. P. Mullins. New York, Pergamon Press, 1959. 295p. $9.80.

The fundamentals of aerothermochemistry are reviewed and the elementary theory of explosion limits without surface reactions in closed reaction vessels is discussed. A qualitative description of the mechanism of complex chemical reactions and explosion limits in closed reaction vessels is given which provides background material to the quantitative theory of chain reactions in closed vessels. A review is given on detonation waves in gases and the published literature written on this subject prior to August 1957 is evaluated. Recent work on flammability limits and the principles of ignition are reported. The Shvab-Zeldovich procedure is applied to the solution of a class of eigenvalue problems of droplet burning. Experimental data on flammability limits of homogeneous fuel-oxidant mixtures and homogeneous fuel-diluent-oxidant mixtures, flammability of heterogeneous fuel-air mixtures, flashpoints, spark ignition, and spontaneous ignition are reviewed and correlated. The basic principles applicable to turbulent combustion in turbojets and ramjets are examined and the prevention of explosions in test plants is discussed. (C.J.G.)

1193

THE ATTAINMENT OF EXHAUST VELOCITIES UP TO 20,000 m/sec BY ISOTHERMAL EXPANSION IN NUCLEAR ROCKETS. F. Winterberg (Gesellschaft fur Kernenergie, Hamburg). p. 181-99 of "IXth International Astronautical Congress, Amsterdam, 1958, Proceedings. [Vol.] I." F. Hecht, ed. Vienna, Springer-Verlag, 1959. p.1-506. (In German)

Previous considerations concerning the thermal propulsion of nuclear rockets led to an upper limit of the exhaust velocity of 10,000 m/sec with hydrogen as expellant. This upper limit is determined by the maximal permissible temperature of the reactor materials. This maximal permissible temperature is for all known structure materials without exception below 5000°. It is shown that, if the expellant is expanded isothermally instead of adiabatically in Laval nozzles, the exhaust velocity can be increased to arbitrarily high velocities without exceeding a permissible maximal temperature of the structure materials. Technically, however, exhaust velocities of more than 20,000 m/sec will probably never be realized, since the size of the machinery increases rapidly with increasing exhaust velocity. Those obtainable will nevertheless exceed anything previously discussed. (auth)

1194

ADVANCED PROPULSION SYSTEMS FOR SPACE VEHICLES. Ernst Stuhlinger (Army Ballistic Missile Agency, Redstone Arsenal, Ala.). p. 232-42 of "IXth International Astronautical Congress, Amsterdam, 1958, Proceedings. [Vol.] I." F. Hecht, ed. Vienna, Springer-Verlag, 1959. p.1-506

Chemical, solar-heated, nuclear-heated, arc-heated, plasma jet, and electrostatic ion propulsion systems are compared as to their performance on space vehicles. Chemical systems appear feasible and useful for space missions. Solar-and also nuclear-heated systems are promising only when liquid hydrogen is used as a propellant. Arc-heated systems are less attractive from an over-all weight standpoint than chemical systems. Plasma jet systems can provide a high specific impulse, but they need much auxiliary equipment. Electrostatic ion systems appear feasible and attractive from a weight standpoint, as long as accelerations of about 10^{-4} G are acceptable. The decisive figure for the last two systems is the "specific power" measured in kg per kw. The exhaust velocity has an optimum value for each given flight mission and specific power. At this optimum exhaust velocity, the total mass of the vehicle is a minimum. (auth)

1195

LIMIT PERFORMANCES OF ION PROPULSION OF SPACE SHIPS EMPLOYING FISSION POWER OF URANIUM NUCLEI OR FUSION POWER OF DEUTERIUM NUCLEI. Enrico Ostinelli (Consigliere della Associazione per le Scienze Astronautiche, Rome). p.380-93 of "IXth International Astronautical Congress, Amsterdam, 1958, Proceedings. [Vol.] I." F. Hecht, ed. Vienna, Springer-Verlag, 1959. p.1-506.

A preliminary determination of jet velocities with respect to the mass ratio was made for space vehicles employing fission or deuterium fusion. An analysis is given of the performance of an ion rocket with jet velocity of 200 km/sec, to be placed on a space station, having a mass of 100 tons, for orbit corrections and modifications. The limit performances of a deuterium fusion space vehicle, propelling ions at 36,000 km/sec, are considered. (W.D.M.)

1196

SOURCES OF RADIATION FOR PHOTONIC JET PROPULSION. Eugen Sänger (Forschungsinstitut für Physik der Strahlantriebe e.V., Stuttgart-Flughafen). p. 817-27 of "IXth International Astronautical Congress, Amsterdam, 1958, Proceedings. [Vol.] II." F. Hecht, ed. Vienna, Springer-Verlag, 1959. p.507-970.

The scope within which photonic jet propulsion can compete with the other systems of jet propulsion is seen to lie in interstellar space travel, and with traveling speeds exceeding perhaps one million km/h. Gas plasmas of a sufficiently high radiation pressure, perhaps consisting of elements from the upper part of the periodic table of elements were considered as sources of radiation at temperatures around 150,000°K. Black radiation may be approximately expected from these plasmas, with optical layer thicknesses that are technically conceivable. (auth)

1197

AUSTRALIAN ATOMIC ENERGY SYMPOSIUM, 1958. Proceedings of a Symposium on the Peaceful Uses of Atomic Energy in Australia held in Sydney from June 2 to 6, 1958. Melbourne, Melbourne University Press, 1958. 797p.

A selection of 114 papers presented at the 1958 Australian Symposium on Peaceful Uses of Atomic Energy are included. Of these papers, 39 have previously been presented in NP-6829, abstract 13642, NSA, Vol. 12. Abstracts were prepared for the remaining papers. (C.J.G.)

1198

PRODUCTION OF URANIUM METAL. F. L. Cuthbert (National Lead Co. of Ohio, Cincinnati). p.102-10 of "Australian Atomic Energy Symposium, 1958."

The mining, milling, and concentration of uranium ores and the production of uranium compounds and uranium metal are basic to the development and growth of the peaceful uses of atomic energy. A brief description of those processes found most suitable for the concentration of uranium ores mined in the United States is given. The extraction and purification of uranium from these concentrates are described, with particular emphasis on the use of pulse plate liquid-liquid extraction columns and tributyl phosphate-kerosene solvent. The production of intermediate uranium products suitable for subsequent processing to reactor grade uranium metal or for diversion to produce uranium hexafluoride is discussed. One of the products, uranium tetrafluoride (UF_4), is reduced to massive uranium metal with magnesium to produce either a "dingot" suitable for further fabrication, or to a "derby" satisfactory for remelting in a vacuum induction furnace along with solid metal scrap. The ingot so produced can be fabricated directly into reactor fuel elements by rolling or extrusion followed by machining. In addition to the description of these processes, consideration is given to the recovery of valuable residues. (auth)

1199

SOME ASPECTS OF THE PRODUCTION OF URANIUM POWDER BY CALCIUM REDUCTION OF THE OXIDE. R. H. Myers and R. G. Robins (New South Wales Univ. of Tech., Kensington). p.111-14 of "Australian Atomic Energy Symposium, 1958."

The production of uranium powder by the calcium reduction of uranium dioxide is discussed. It is shown that about 30% excess calcium reductant is needed for effective reduction; the effects of time and temperature of heating of the reaction products, and size of reaction vessel, on the nature of the powder are given. (auth)

1200

THE PRODUCTION OF URANIUM METAL POWDER BY ELECTROLYSIS IN MOLTEN CHLORIDES. R. G. Canning (Dept. of Mines, Parkside, South Australia). p.115-22 of "Australian Atomic Energy Symposium, 1958."

The conversion of uranium oxides to chlorides in molten chloride medium is described. In the graphite-chlorine reaction employed, the efficiency of chlorine absorption is shown to be dependent on temperature and on the concentration of uranium in the melt. Uranium metal powder is recovered by controlled precipitation with magnesium metal, followed by electro refining on to a molybdenum cathode. Some contamination is derived from graphite and mullite crucibles. A method of preliminary purification of impure oxide is described in which electrolytic UO_2 is produced from a chloride melt containing UO_2Cl_2. (auth)

1201

THE PREPARATION OF URANIUM POWDER BY A HYDRIDING PROCESS. J. W. Kelly (Australian Atomic Energy Commission Research Establishment, Lucas Heights, New South Wales). p.123-7 of "Australian Atomic Energy Symposium, 1958."

The hydriding process involves conversion of uranium metal to uranium hydride and then decomposition of uranium hydride at 310°C. Free-running micron sized uranium powder was produced on a 3-gram scale but all attempts to scale up the work failed due to sintering of the powder. Small-scale experiments indicated that sintering was due to impurities in the hydrogen. (C.J.G.)

1202

THE LOWER HALIDES OF NIOBIUM AND ZIRCONIUM. I. E. Newnham (Commonwealth Scientific and Industrial Research Organization, Melbourne). p.128-31 of "Australian Atomic Energy Symposium, 1958."

Processes for separating hafnium from zirconium and tantalum from niobium are based on the fact that the pure trihalides of zirconium and niobium can be prepared by differential reduction of the mixed tetrahalides of zirconium and hafnium, and of the mixed pentahalides of tantalum and niobium respectively. Because the yield of trichloride decreases with increasing reaction temperature, a room-temperature reduction process was investigated for zirconium tetrachloride and niobium pentachloride. The differential reduction of zirconium tetrachloride and niobium pentachloride by atomic hydrogen at temperatures below 200°C is described. (auth)

1203

MATERIALS FOR THE CONTROL OF NUCLEAR REACTORS. W. J. Wright and K. P. Nicholson (Australian Atomic Energy Commission Research Establishment, Lucas Heights, New South Wales). p.132-7 of "Australian Atomic Energy Symposium, 1958."

The desirable properties of neutron absorbers are discussed, and the investments for the equivalent absorption in various materials are calculated. Physical and metallurgical limitations exist in the use of boron and cadmium, and the investment for blackness compared to burn-up in hafnium is unattractive. The rare earths, gadolinium, samarium, and europium are discussed, and dispersions of the oxides in steel are suggested for use as control elements in future high temperature reactors. (auth)

1204

RECENT PROGRESS IN REACTOR MATERIALS DEVELOPMENT. F. W. Albaugh, R. E. Nightingale, E. A. Evans, J. W. Riches, and R. L. Dillon (General Electric Co., Richland, Wash.). p.140-52 of "Australian Atomic Energy Symposium, 1958."

Progress made in reactor materials development at Hanford laboratories in 1957 is discussed. The subjects considered are the effects of high temperature on certain properties of graphite, development of improved thermocouple materials for in-reactor use, improvement of elastomer materials for reactor service, development studies on the use of zirconium alloys for process tubes and of zirconium and aluminum alloys for fuel jacketing, uranium dioxide fuel element development, and the properties of some concrete shielding materials at elevated temperatures. (C.J.G.)

1205

SPECIAL CERAMICS AND CERMETS INVESTIGATIONS AT DIVISION OF INDUSTRIAL CHEMISTRY, C.S.I.R.O. L. S. Williams and J. Graham (Commonwealth Scientific and Industrial Research Organization, Melbourne). p.153-60 of "Australian Atomic Energy Symposium, 1958."

The range of established and potential nuclear applications of ceramics and cermets, and the special factors of irradiation and neutron economy, are discussed. The studies discussed include laboratory ware, improved hot pressing dies, resistance furnace elements, and oxide-based cermets. (auth)

1206

NEUTRON DIFFRACTION STUDIES IN SOME SINTERED UO_2-ThO_2-BeO COMPACTS. K. D. Reeve and T. M. Sabine (Australian Atomic Energy Commission Research Establishment, Lucas Heights, New South Wales). p.168-71 of "Australian Atomic Energy Symposium, 1958."

The results of a neutron-diffraction study of sintered UO_2-ThO_2-BeO compacts are given. A comparison between calculated and observed values of the intensity and positions of the diffraction spectra shows that the compacts are a simple mixture of BeO and UO_2-ThO_2 solid solution. It is shown that better resolution than that of the BEPO powder spectrometer is necessary before the technique can be applied generally. (auth)

1207

THE PREPARATION OF THORIUM CARBIDE AND SOME ASPECTS OF THE HIGH TEMPERATURE DECONTAMINATION OF IRRADIATED CARBIDE FUELS. D. E. Scaife and A. W. Wylie (Commonwealth Scientific and Industrial Research Organization, Melbourne). p.172-81 of "Australian Atomic Energy Symposium, 1958."

A study was made of factors influencing the synthesis of thorium dicarbide from thorium oxide and carbon, and of the volatilization of impurity elements from thorium carbide at high temperatures. Temperature is the most important variable, and under suitable conditions over 99% of thorium oxide can be converted to carbide in 30 minutes at 2130°C. Radiometric and other techniques were used to follow the volatilization of impurity elements from the carbide above 2000°C. The experimental results are correlated with thermodynamic functions, ΔF, for vaporization of these elements, and it is shown that at 2130°C, the ΔF values of yttrium and the rare earths divide a selection of 24 elements into two groups. The first group has ΔF values less than those calculated for the rare earths, and all elements comprising it are substantially volatile at 2130°C. The second group has ΔF values greater than those calculated for the rare earth elements, and all elements comprising it are substantially non-volatile at 2130°C. The thermal decontamination of thorium carbide from fission product poisons is discussed. Isotopes of Cs, Sr, Be, Ba, Sm, Eu, Ag, and Cd can be removed at 2130°C. The possibility of further substantial decontamination at higher temperatures is examined. (auth)

1208

PROGRESS IN THE STUDY OF GAS-METAL REACTIONS AT HIGH TEMPERATURE. G. R. Wallwork and A. E. Jenkins (New South Wales Univ., of Tech., Kensington). p.182-5 of "Australian Atomic Energy Symposium, 1958."

Experimental evidence gained from an examination of the oxidation of titanium, zirconium, and hafnium at temperatures within the range 600 to 950°C suggests that the solution of oxygen in the metal phase and the movement of the diffusion gradient so formed is the controlling factor in the oxidation of these metals. Many conclusions based on the behavior of thin sections of metal exposed to oxygen at high temperatures for long periods may, therefore, be in error due to oxygen penetrating to the center of such specimens. (auth)

1209

SOME STUDIES OF CORROSION IN LIQUID METAL. H. M. Finniston (Atomic Energy Research Establishment, Harwell, Berks, Eng.). p.189-96 of "Australian Atomic Energy Symposium, 1958."

The kinetics of solutions in liquid metals were shown to be analogous to the kinetics of reaction in chemical systems based on aqueous and non-aqueous solvents and in most cases studied resembles the transfer of heat across a solid-coolant interface. Differential solubility of the solute with temperature of the liquid metal was found to be responsible for thermal gradient mass transfer. The precipitation process in mass transfer did not seem to be the rate controlling step. Chromium steel thermal loops in an ammonia atmosphere and operating under a gradient of 450 to 550°C showed no mass transfer after 3,000 hours running with liquid bismuth containing 500 ppm of both calcium and zirconium. The film formed under these conditions was zirconium nitride, about 200 A thick with a nitrogen content of the walls of the loop between 0.3 and 1%. (C.J.G.)

1210

COMPATIBILITY BETWEEN SOLID AND LIQUID METALS. F. L. Bett (Australian Atomic Energy Commission Research Establishment, Lucas Heights, New South Wales). p.201-5 of "Australian Atomic Energy Symposium, 1958."

Compatibility between solid and liquid metals is defined. Several mechanisms are described by which compatibility may be reduced. The types of tests which are used to assess compatibility are also described. A description is given of investigations into the compatibility of niobium with liquid sodium. (auth)

1211

PROBLEMS IN THE SELECTION OF MATERIALS FOR FUEL ELEMENT CANS IN GAS-COOLED NUCLEAR POWER REACTORS. B. C. Woodfine (General Electric Co., Ltd., Erith, Kent, Eng.). p.208-15 of "Australian Atomic Energy Symposium, 1958."

The general problems which influence the choice of a material for fuel element cans in carbon dioxide-cooled graphite-moderated natural uranium powder reactors are considered, and the reasons for selecting a magnesium alloy for use in Calder Hall and the British civil power reactors are summarized. The development of the present Magnox A.12 canning alloy is outlined, and some of the problems which have arisen with this alloy are discussed. These problems include thermal ratchetting, the low-temperature ductility of the alloy, the development of intergranular voids, and the factors limiting the operating temperature of the alloy. The possible use of beryllium, carbon, and stainless steel as fuel element canning materials in carbon dioxide-cooled reactors above 500°C is discussed with particular reference to the properties of beryllium and the difficulties associated with its use. Fuel element canning problems which might arise with the use of gaseous coolants other than carbon dioxide are briefly considered. (auth)

1212

FUSION WELDING OF THE LESS COMMON METALS. J. M. Newburn (New South Wales Univ. of Tech., Kensington). p.216-20 of "Australian Atomic Energy Symposium, 1958."

A review of the literature on the fusion welding of beryllium, hafnium, niobium, tantalum, thorium, titanium, uranium, vanadium, and zirconium revealed that with the exception of beryllium, ductile welds may readily be produced by the inert gas shielded arc process, although special precautions against atmospheric contamination are necessary. Satisfactory fusion welds in beryllium were not reported. (auth)

1213

LEVITATION HEATING AND ITS METALLURGICAL POSSIBILITIES. B. Harris, E. G. Price, and A. E. Jenkins (New South Wales Univ. of Tech., Kensington). p.221-5 of "Australian Atomic Energy Symposium, 1958."

The use of a high-frequency current flowing in a specially designed induction coil for the purpose of simultaneously lifting and heating metals and other conductors is reviewed. Progress in two existing research programs is then discussed under the following headings; the development and use of a versatile controlled atmosphere levitation unit, and a study of the variables associated with the levitation process. The use of the levitation technique in its present form is examined, and some further consideration is given to possible uses should a significant improvement in the scale of operation be obtained. (auth)

1214

SOME EFFECTS OF IRRADIATION ON URANIUM AND URANIUM-BASED ALLOYS. H. M. Finniston (Atomic Energy Research Establishment, Harwell, Berks, Eng.). p.226-33 of "Australian Atomic Energy Symposium, 1958."

The effects of irradiation on uranium and its alloys exhibited two major phenomena. The first of these, "growth," which is associated with a change in shape of the metal under irradiation, occurs in the temperature range up to 480°C, decreasing in magnitude with increasing temperature. The wrinkling of uranium under irradiation reflects the irradiation growth of individual grains at the specimen surface. The technological solution to growth is the avoidance of preferred orientation, either by special choice of fabrication method or by beta heat treatment; the solution to wrinkling is a fine grain size also achieved by beta heat treatment, with or without alloying of the base metal. At higher temperatures above 400 to 450°C the phenomenon of swelling due to the accumulation of the fission product gases in pockets, both bubbles and cracks results in a decrease in density. This decrease can be very considerable, and depends upon the extent of burn-up of the alloy, its composition, and indeterminately to the temperature of irradiation. Both growth and swelling under irradiation are complicated by the anisotropy of the alpha-uranium phase. (auth)

1215

THE NUCLEAR POWER PROGRAM IN THE UNITED KINGDOM. H. H. Gott (United Kingdom Atomic Energy Authority, Risley, Eng.). p.235-8 of "Australian Atomic Energy Symposium, 1958."

A general review is given on technical and operating problems related to the nuclear power program in the United Kingdom. The power program for the future is discussed. (C.J.G.)

1216

THE ECONOMICS OF ELECTRICITY GENERATION IN QUEENSLAND AND THE POTENTIAL EMPLOYMENT

OF NUCLEAR REACTORS. p.265-72 of "Australian Atomic Energy Symposium, 1958."

A discussion is presented on the future electrical output requirement for Queensland. The potential employment of nuclear reactors at various locations is discussed relative to economic and load factors and completion date. Pumped storage seems to be the most practical method of improving load factor at the present. There seems to be very little possibility of nuclear power taking the place of coal in the electricity supply industry of Queensland before 1977. (C.J.G.)

1217

THE GROWTH IN DEMAND FOR ELECTRICITY IN AUSTRALIA. p.273-81 of "Australian Atomic Energy Symposium, 1958."

The estimated peak demand for electricity in Australia is projected in ten year intervals to 2000. The forecast of the electricity demand was made by analyzing population growth, previous proportion of national income taking the form of energy products, and previous annual factors of increase in the proportion of electricity to total energy. (C.J.G.)

1218

MEDIUM OUTPUT GAS-COOLED GRAPHITE-MODERATED REACTORS FOR AUSTRALIA. A. L. Shaw (AEI-John Thompson Nuclear Energy Co., Ltd., Knutsford, Ches., Eng.). p.284-98 of "Australian Atomic Energy Symposium, 1958."

A comparison of the concentrations of inter-connected power and associated base loads in Australia and the United Kingdom indicates that, from a purely operational viewpoint, the maximum size of reactor unit which might be accommodated in Australian networks will be somewhat smaller than those projected for future construction in Britain. Local power economics narrow the field of possible immediate application. For network-integrated operation, a single-reactor 150 Mw station might be economically justifiable at present. The case of Northern Ireland, with network capacity and economic conditions similar to a typical Australian State, offers an interesting comparison. The general characteristics of a 150 Mw station, suitable for immediate construction in Australia, would be similar to those of a scaled-down British station of the second stage of development, more advanced in design and performance than Hinkley Point. For use in isolated industrial areas, a smaller unit fuelled either by natural or slightly enriched uranium, with a mixed output of process steam and power, could be economic at present, but the degree to which this is true will depend on the local cost of coal or oil as delivered. Experience with the Berkeley nuclear power station illustrates the siting and local construction problems involved. Control, staffing, and staff training problems involved in nuclear power station operation are discussed. Capability of Australian conventional industry to participate in the construction of a nuclear power station is estimated to be worth potentially about 45% of the total cost of the station; although this proportion is considered likely to be minimal. (auth)

1219

ENGINEERING ASPECTS OF NUCLEAR POWER STATIONS EMPLOYING GAS-COOLED, GRAPHITE MODERATED REACTORS. K. J. Wootton (General Electric Co., Erith, Kent, Eng.). p.299-306 of "Australian Atomic Energy Symposium, 1958."

The 360 Mw station now being built at Hunterston, England is briefly described. The basic fuel element specification is outlined, with the development of the Hunterston fuel element. Fuel handling schemes are examined briefly, and the reasons for the choice of bottom charging and discharging for the Hunterston reactors studied. The main engineering problems associated with the reactor pressure vessel are stated, and methods of solution described. Heat exchanger design is discussed briefly, and experimental studies indicated. The effect of current developments in reactor technology on economical reactor size, cost per kw installed, and costs per unit sent out are indicated, and possible trends outlined. (auth)

1220

DESIGN OF THE GAS-COOLED GRAPHITE MODERATED REACTOR FOR POWER PRODUCTION. R. D. Vaughan (Nuclear Power Plant Co., Ltd., Knutsford, Ches., Eng.). p.307-17 of "Australian Atomic Energy Symposium, 1958."

The gas-cooled graphite-moderated reactor is described, indicating alternative features in the designs now under construction in the United Kingdom. The ways in which a design may be affected by the requirements of a particular purchaser are then indicated in some detail. It is shown how the output, the load factor, ground conditions, and water supply may all have far reaching effects on the design. With preliminary information of this nature available, it is possible to visualize the form a new project will take. The more important plant components and the special problems associated with their incorporation in a power producing reactor unit are described. A section on future trends indicates the improvements to be expected over the next few years in fuel rating and fuel temperature. Some changes in the design of plant components are also foreshadowed as experience is gained with plants now under construction. (auth)

1221

THE HINKLEY POINT REACTORS. H. S. Arms, H. C. Bottrell, and P. H. W. Wolff (English Electric Co., Ltd., Whetstone, Leics, Eng.). p.318-29 of "Australian Atomic Energy Symposium, 1958."

A description of the 500-Mw Hinkley Point power station is given. The design of the gas circuit which utilizes squirrel cage motors powered by separate variable frequency turbo-generators is described. Mechanical design features are given for the core and pressure vessel, fueling gear, shielding facilities, and control equipment. Station instrumentation and reactor safety mechanisms are described. (C.J.G.)

1222

FRENCH PRIVATE INDUSTRY IN THE ATOMIC FIELD. p.330-2 of "Australian Atomic Energy Symposium, 1958."

A description is given of how the French national atomic energy authority has devised the allocating of commitments to enable private industry to increase its contribution toward atomic energy development. (auth)

1223

OPERATIONAL DATA AND EXPERIENCE FROM THE EXPERIMENTAL BOILING WATER REACTOR. J. M. Harrer (Argonne National Lab., Lemont, Ill.). p.333-9 of "Australian Atomic Energy Symposium, 1958."

The performance of the Experimental Boiling Water Reactor during operation is described. During cold hydrostatic tests on the pressure vessel closure, a leakage of 184 cc/hr at 1,040 psig was measured. After 14 thermal cycles from room temperature to 478°F, a leakage of 1700 cc/hr at 1200 psig was measured. No leakage was ever detected during operation at power. The steam decomposition rate at 20 Mw was measured at 9,000 cc/min at 600 psig and 13,000 cc/min at 300 psig. A time of 24 hr was found sufficient to complete removal of fuel from the reactor if cooling is maintained at a rate of about 50°F/hr and temperature differentials across the vessel are kept below 100°F. The complete operation cycle from shutdown to startup required 40 to 48 hours plus the time to change fuel. In BORAX tests the absolute kw liter value at which the reactor became unstable (chugging) was above 30 kw/liter. During chugging, the flux was found to change cycles from the operating value to 0 about once every second. Computer results indicated that instability would occur between 65 and 80 Mw of heat, or at 65 to 80 kw/liter of core power density. The detection of a fuel element failure is discussed. The economics of the program are discussed relative to amortization, fuel costs, maintenance, and operation. (C.J.G.)

1224

GAS-COOLED REACTORS OF A MIXED FUEL-MODERATOR TYPE. G. C. J. Dalton (Australian Atomic Energy Commission Research Establishment, Lucas Heights, New South Wales). p.340-5 of "Australian Atomic Energy Symposium, 1958."

Reactors of this type may use any of the moderators, graphite, beryllium oxide, or beryllium, and one of the coolant gases hydrogen, helium, carbon dioxide, nitrogen, or other suitable gas to be selected on the grounds of compatibility with the moderator and circuit materials and engineering suitability. The uranium-233—thorium fuel cycle is the most suitable because the conversion factor possible with this system is greater than with the plutonium—uranium-238 cycle. Because there is no necessity for lumping the fuel, the moderator may be used to dilute the fuel and to increase the surface available for heat transfer to the coolant. This dilution should also improve the burn-up possible before the fuel element suffers physical disintegration. The fuel and fertile material may be mixed uniformly with the moderator, or may be in a thin, enriched layer near the surface of the element. The fuel elements may be rods, spheres, plates, or bricks, pierced by coolant channels. A discussion is given on the research directed toward the production of a high integrity fuel element, the solution of problems of compatibility of gas and moderator, control of fission products, and reprocessing and refabricating fuel elements. It is expected that this type of reactor will have particular application in the power range of 5 to 50 Mw. (auth)

1225

THE DESIGN AND CONSTRUCTION OF HIFAR. W. H. Roberts (Australian Atomic Energy Commission Research Establishment, Lucas Heights, New South Wales). p.363-79 of "Australian Atomic Energy Symposium, 1958."

A brief description is given of the design and construction of the Australian Atomic Energy Commission's reactor HIFAR, located near Sydney. The description contains designs of the light and heavy cooling water circuits, helium circuits, reactor shield and reflector, fuel elements, and control and instrumentation. The ventilation and electricity supply for the reactor building are described and design of the building is given. The experimental facilities available are discussed. The design of the storage blocks for irradiated fuel and experiments is given. Safety features of the reactor are reported. The reactor design is based on the DIDO. (C.J.G.)

1226

AN INDUSTRIAL RESEARCH REACTOR. T. E. Allibone, D. R. Chick, and A. J. Salmon (Associated Electrical Industries, Ltd., Aldermaston, Berks, Eng.). p.397-405 of "Australian Atomic Energy Symposium, 1958."

A description is given of the pool-type research reactor to be completed in the summer of 1958 at Aldermaston, England. The site and the site facilities are also described. Some examples are given of the fundamental and applied aspects of the research proposed. The reactor is cooled and moderated by light water, and has a maximum operating thermal power of 5 Mw. Plate fuel elements are used, the uranium is enriched to more than 90% U^{235}. The minimum critical mass of the core is 2.7 kgm U^{235}. A central fuel element can be omitted to provide experimental space in the region of maximum radiation flux; the minimum critical mass will then be 3.1 kgm U^{235}. The maximum reactivity invested in the core will be 0.055. The experimental facilities are tabulated, and the radiation fluxes available in them are given. At 5 Mw, with the core water-reflected, the maximum thermal neutron flux will be 5×10^{13} n/sq cm/sec and the maximum epithermal flux will be 2×10^{14} n/sq cm/sec. The corresponding fluxes with the core reflected by 2.5 in. of beryllia are 7×10^{13} n/sq cm/sec and 3×10^{14} n/sq cm/sec. The reactor is unusual in that the core can be moved vertically in the pool to any one of four positions; storage, lower experimental, upper experimental, and a position for working on the core. Some safety and control aspects of the system are briefly discussed. (auth)

1227

CHEMICAL PROCESSING OF IRRADIATED URANIUM. J. E. Cole (E. I. du Pont de Nemours and Co., Wilmington, Del.). p.408-12 of "Australian Atomic Energy Symposium, 1958."

A review is given of the chemical processing methods for irradiated uranium relative to equipment involved and the economics of separation plant operations. (C.J.G.)

1228

THE FUTURE OF NUCLEAR FUEL REPROCESSING IN AUSTRALIA. G. L. Miles (Australian Atomic Energy Commission Research Establishment, Lucas Heights, New South Wales). p.413-19 of "Australian Atomic Energy Symposium, 1958."

An attempt is made to predict the nature and scale of the nuclear fuel reprocessing industry which might be expected to develop in Australia up to about 1975, and to indicate the kind of technical advances which will be required to achieve this. (auth)

1229

ACID LEACHING AND ANODE DISSOLUTION OF GRAPHITE-MODERATED FUELS. K. R. Hyde and J. L. Woodhead (Atomic Energy Research Establishment, Harwell, Eng.) and D. J. O'Connor (Australian Atomic Energy Commission Research Establishment, Lucas Heights, New South Wales). p.420-8 of "Australian Atomic Energy Symposium, 1958."

Results of nitric acid leaching and anodic disintegration processing studies of two types of homogeneous graphite moderated fuels are reported. A 2N nitric acid leaching at 90 to 100°C appears suitable as the primary processing method, whereby uranium and thorium are obtained in solution suitable for solvent extraction. Anodic disintegration in 2N nitric acid is a satisfactory wet method of breaking down the graphite fuel assemblies, but the disintegration process does not give the required uranium and thorium recoveries. It was not possible to assign any electrochemical action to the anodic solution of uranium and thorium carbides. (auth)

1230

HANDLING, TREATMENT, AND DISPOSAL OF RADIOACTIVE WASTES. Joseph A. Lieberman (U. S. Atomic Energy Commission, Washington, D. C.). p.435-46 of "Australian Atomic Energy Symposium, 1958."

A review is presented on the disposal of radioactive wastes arising from raw materials and metal fabrication operations. Treatment of the wastes for storage are discussed relative to evaporation, neutralization, precipitation, crystallization, and ion exchange. The effects arising from ultimate disposal of these wastes to the environment are discussed. (C.J.G.)

1231

NUCLEAR STEAM POWER PLANT FOR WATERLESS ZONES. W. R. Wootton (Babcock and Wilcox, Ltd., London). p.448-54 of "Australian Atomic Energy Symposium, 1958."

By taking maximum advantage of the development of all-welded construction (to eliminate loss of water by leakage through joints), of glandless pumps, and of condensing turbine glands, consideration can be given to nuclear steam power plant. Envisaging an ambient air temperature of 100°F and a simple design of hermetic, air-cooled condenser, a current design of gas-cooled, graphite-moderated reactor (substantially of the Calder Hall type) can lead to the production of electricity at low cost. Such a plant, it is emphasized, is orthodox except that it is down-rated by some 25% by condensing at a vacuum of only 20 in Hg. instead of 29 in Hg. The air-cooled condenser, forced-cooled by motor-driven propeller fans, can replace the conventional shell-and-tube condenser, cooling water system and cooling tower, not only physically, but both in capital and running costs. An extended cooling surface of the fin-tube or stud-tube type, with air flowing over the tubes and steam condensing inside is utilized, the external surface area being 10 or 11 times that of bare tube of the same diameter. The cost is dependent upon many factors peculiar to the intended site, and any attempt to qualify the cost of a plant, as it might be built in Britain, for such conditions is uncertain. Nevertheless, an estimate aids in establishing its feasibility. The station proposed is a 40,000 kw plant, downrated to 30,000 kw by suppression of the vacuum at the turbine exhaust. The down-rated plant is expected to cost a little less, but its fuel consumption would be appreciably higher. (auth)

1232

SIMILITUDE IN GAS TURBINES FOR NUCLEAR POWER PLANTS. G. G. McDonald (Univ. of Sydney). p.455-62 of "Australian Atomic Energy Symposium, 1958."

Thermodynamic equations for the thermal efficiency of a gas turbine engine and the nondimensional "Rateau" groups which apply to geometrically similar gas turbine stages are given for any gas. Considering the gases helium, nitrogen, carbon dioxide, and air, and assuming the blade speed u and wheel diameter d of the mean turbine stage to be fixed, the performance of the stage, covering flow of gas per second, number of stages, turbine power, stage efficiency ratio and overall thermal efficiency is expressed in terms of the performance with nitrogen. Carbon dioxide seems to be the best of the three gases from the point of view of turbine performance at the assumed inlet pressure of 750 lb/sq in. and temperature 750°C. Simple ideas of heat transfer are applied to the heater or reactor core, where the total heat quantity and the temperature differences are kept constant while the gas and length of the core are varied. The weight flow per second, heating surface, pressure drop and specific pumping power for helium and carbon dioxide are compared with those for nitrogen, and carbon dioxide. (auth)

1233

NUCLEAR POWER REACTOR AND TURBO-ALTERNATOR INTERACTION UNDER DYNAMIC CONDITIONS. H. K. Messerle and J. F. Armstrong (Univ. of Sydney). p.463-70 of "Australian Atomic Energy Symposium, 1958."

The effect of a steam-raising plant on the dynamic stability of turbo-alternators with standard speed governors is investigated, and it is shown that the stability can be modified quite considerably if nuclear reactors are used as heat source. (auth)

1234

HEAT TRANSFER IN HOMOGENEOUS GAS-COOLED REACTORS. G. de Vahl Davis (Australian Atomic Energy Commission Research Establishment, Lucas Heights, New South Wales). p.471-4 of "Australian Atomic Energy Symposium, 1958."

The heat source distribution in a nuclear reactor is a function of neutron flux, fuel loading, and core temperature, each of which is a function of position. In certain types of solid fuel gas-cooled reactors, the fuel distribution is such that the reactor may be regarded as homogeneous. The method of calculating the temperature distribution in the core of such a reactor is described. A cylindrical core is assumed, and the variations of coolant flow and outlet temperature with radius are found. As a first approximation the dependence of neutron flux on temperature is taken to be small, and the flux is assumed to have been calculated on the basis of uniform core temperature. Using this flux distribution, the first core temperature distribution is found. Subsequent flux distributions can be calculated to refine the values of temperature. (auth)

1235

THE GROUND STATE OF THE TRITON—EFFECT OF REPULSIVE CORE FORCES. J. M. Blatt and G. Derrick (Univ. of Sydney). p.489-91 of "Australian Atomic Energy Symposium, 1958."

A variational calculation is made for H^3 with repulsive core forces fitted to two-body data. The results are almost independent of the hard core radius. (auth)

1236

THE GROUND STATE OF THE TRITON—GROUP THEORETICAL CLASSIFICATION OF WAVE FUNCTIONS. G. Derrick and J. M. Blatt (Univ. of Sydney). p.492-7 of "Australian Atomic Energy Symposium, 1958."

A group theoretical classification is made of all angular momentum and isotopic spin functions which can be present in the ground state wave function of H^3. (auth)

1237

NUCLEAR FORCES AT VERY SMALL DISTANCES. S. T. Ma (Univ. of Sydney). p.498-9 of "Australian Atomic Energy Symposium, 1958."

The hard core which has been postulated for the nuclear forces is compared with the core interaction between an electron and an atomic nucleus, deduced from Dirac's theory of the electron. (auth)

1238

THE CHARGE SPECTRUM OF PRIMARY COSMIC RADIATION. A. J. Herz (Univ. of Sydney). p.501-4 of "Australian Atomic Energy Symposium, 1958."

A review is given of experimental data and literature on the composition of primary cosmic radiation. Current theory regarding the origin of cosmic rays is presented and the abundance of the light nuclei Be, B, and Li in cosmic-rays is discussed. (C.J.G.)

1239

RECENT SYDNEY WORK ON THE CHARGE SPECTRUM OF HEAVY COSMIC-RAY PRIMARIES. F. A. Brisbout, A. J. Herz, J. H. Noon, B. J. O'Brien, and N. Solntseff

(Univ. of Sydney). p.505-11 of "Australian Atomic Energy Symposium, 1958."

An outline is given of the techniques used for the identification of relativistic heavy primary cosmic-ray nuclei whose tracks are observed in nuclear-emulsion stacks. In the experiment on the charge spectrum carried out by this group, measurements were made by three different methods and the correlation between the results obtained was such as to exclude the possibility that a major systematic error affected any one of the sets of measurements. The results show that 12g/cm^2 below the top of the atmosphere, the abundance of the light elements lithium, beryllium, and boron is of the order of 60% of that of the medium elements carbon, nitrogen, oxygen, and fluorine. To allow the extrapolation of observed abundances to the top of the atmosphere, an analysis is being made of the collisions and collision products of heavy primary nuclei passing through sheets of a plastic consisting entirely of carbon and fluorine. The plastic is interleaved with sheets of nuclear emulsion, in which the tracks of the particles are observed. (auth)

1240

ENERGY SPECTRUM OF PARTICLES BOMBARDING THE EARTH. B. J. O'Brien (Dept. of External Affairs, Melbourne). p.512-13 of "Australian Atomic Energy Symposium, 1958."

A review is given of the high-energy cosmic particles (>10^9 ev), interstellar matter of 10 ev, and auroral protons of 10^5 ev which bombarded the earth. (C.J.G.)

1241

SYDNEY AIR SHOWER EXPERIMENT—PAPER 2: THE DETERMINATION OF THE RADIAL DISTRIBUTION OF ELECTRONS, AND THE SIZE SPECTRUM, OF EXTENSIVE AIR SHOWERS. C. S. Wallace (Univ. of Sydney). p.518-21 of "Australian Atomic Energy Symposium, 1958."

A method used for the analysis of cosmic ray showers is described. It is shown that the observed fluctuations of response of the large liquid scintillation counters used in this experiment are in approximate agreement with the Poissonian form assumed in the analysis. The observed lateral structure of the showers is also shown to agree with the assumed form. Details of a comparison between the response of Geiger counters and that of scintillation counters to the air shower flux are given, and it is shown that the relationship between them varies with distance from the shower axis. A rough estimate of the rate of occurrence of large showers is given. (auth)

1242

THE SYDNEY AIR SHOWER EXPERIMENT—PAPER 4: THE RADIAL DISTRIBUTIONS OF HIGH ENERGY NUCLEAR-ACTIVE PARTICLES AND μ-MESONS IN COSMIC RAY AIR SHOWERS. J. A. Lehane (Univ. of Sydney). p.525-8 of "Australian Atomic Energy Symposium, 1958."

The radial distributions of high energy nuclear-active particles and μ-mesons were determined in the range of distance 0 to 50 meters from the core. A distribution of the form $r^{-0.5}$ was found for the μ-mesons, and a distribution of the form $r^{-1.2}$ for the nuclear-active particles. The results were compared with other experimental work and with the predictions of the theoretical model of the high-energy nuclear cascade proposed by Ueda and Ogita. Such a comparison results in an estimate of approximately 0.5 for the inelasticity in a high-energy nucleon-nucleus collision. (auth)

1243

SOME RECENT DEVELOPMENTS IN THE THEORY OF DOPPLER BROADENING OF NUCLEAR RESONANCE REGIONS. J. L. Cook (New South Wales Univ. of Tech., Kensington). p.534-40 of "Australian Atomic Energy Symposium, 1958."

A survey of the results obtained in extending the theory of Doppler broadening of neutron resonance absorption regions is given, with specific application to reactors. A sample calculation for a model reactor is given. A more precise expression for the area under a resonance is derived, taking into account resonance asymmetry. A method of correcting self-shielding factors is presented. (auth)

1244

ON THE SECOND ORDER TERMS IN THE AGE THEORY OF NEUTRON DISTRIBUTION. L. C. Woods (New South Wales Univ. of Tech., Kensington). p.541-6 of "Australian Atomic Energy Symposium, 1958."

A method of computing the correction terms for Fermi's age theory is given. The method is based on the P_3 approximation, and on expansions of the scattering integrals up to terms of second order in the collision interval. A new derivation of the spherical harmonic moments of the transport equation for a general geometry is given. (auth)

1245

THE HIFAR OSCILLATOR. K. P. Nicholson and A. W. Pryor (Australian Atomic Energy Commission Research Establishment, Lucas Heights, New South Wales). p.547-51 of "Australian Atomic Energy Symposium, 1958."

A description is given of a pile oscillator which will enable thermal absorption cross section measurements to be made on HIFAR. The principal design factors are discussed, with particular reference to the effects of scattering by the sample, and the extension of the range of cross section measurements to include moderators such as graphite and beryllium. (auth)

1246

IMPERFECTIONS INDUCED IN SOLIDS BY FAST PARTICLE IRRADIATION. P. G. Klemens (Commonwealth Scientific and Industrial Research Organization, Sydney). p.555-61 of "Australian Atomic Energy Symposium, 1958."

The radiation damage produced in solids by fast particles is discussed qualitatively, with particular reference to the clustering of displacements, the liberation of heat, and the recovery of damage. The imperfections induced by irradiation affect many physical properties, and irradiation is a useful tool in the study of lattice imperfections. This is illustrated by means of the electrical resistance changes and recovery stages of copper damaged by cold work, quenching, and irradiation. The thermal conductivity of non-metals is sensitive to lattice imperfections, and the temperature dependence of the thermal resistivity depends upon their nature. Changes in the thermal conductivity of quartz on neutron irradiation are discussed, and compared with density changes. (auth)

1247

CHEMISTRY OF POSITRONIUM. John Lee and J. H. Green (New South Wales Univ. of Tech., Kensington). p.563-7 of "Australian Atomic Energy Symposium, 1958."

The three methods of studying the formation of positronium are discussed with particular reference to the development of positronium chemistry. The design and initial performances of a new instrument for this work are briefly described. (auth)

1248

DISTRIBUTION STUDIES AND STEREOSPECIFICITY IN RECOIL TRITIUM LABELLING OF ORGANIC COMPOUNDS. W. G. Brown (Univ. of Chicago) and J. L. Garnett (New South Wales Univ. of Tech., Kensington). p.575-9 of "Australian Atomic Energy Symposium, 1958."

The mechanism of recoil tritiation of organic compounds was studied using as model systems, the optically active octyl phthalates and 17-α-hydroxyprogesterone. In the former case, there is a strong preference for retention of configuration when substitution of recoil tritium occurs on an asymmetric carbon atom. With the latter compound, distribution experiments indicate that tritium incorporation is not random in labeled 17-α-hydroxyprogesterone. (auth)

1249

CHEMICAL FATE OF RECOILING FISSION FRAGMENTS. D. Hall (Univ. of Auckland, N. Z.). p.580-2 of "Australian Atomic Energy Symposium, 1958."

A study was made of the association of iodine fission fragments with the elementary iodine formed by uranyl iodate decomposition on irradiation. The proportion thus associated is independent of neutron dose, and is as follows: Iodine 131, 14%, iodine 132, ~35%, iodine 133, 18%, iodine 135, ~60%. The results indicate that the chemical fate of the recoil atom is determined in a reaction involving the primary fragment and its environment. (auth)

1250

THE SOLUTION OF LIME IN LIQUID CALCIUM AND ITS EFFECT ON THE REDUCING PROPERTIES OF THE METAL. D. J. M. Bevan and F. D. Richardson (Imperial Coll., London). p.586-7 of "Australian Atomic Energy Symposium, 1958."

Experiments indicate that although the solubility of lime in molten calcium is not more than 0.3 mole % at the melting point, the solubility at 1350°C may be nearer 20 mole %. The oxygen potential of the system Ca (saturated with CaO) + CaO (solid) is thus about 1.4 Kcal less negative than for Ca (pure liquid) + CaO (solid). (auth)

1251

THE OXIDATION OF PARTICLES OF URANIUM DIOXIDE. J. S. Anderson (Univ. of Melbourne). p.588-98 of "Australian Atomic Energy Symposium, 1958."

Density measurements on oxides of formula UO_{2+x} ($0 < x < 0.35$) show that oxygen in excess of the formula UO_2 occupies interstitial positions in the non-stoichiometric cubic oxide, in U_4O_8 (the β-phase) and in the tetragonal γ' and γ'' ordered phases. The course of oxidation of monocrystalline particles of UO_2 was studied by following changes in the profile of X-ray diffraction lines. For oxidation at low temperatures (less than 180°C), the results accord with those predicted for a diffusion controlled process, in which a concentration gradient is set up from surface to center of the particle, but not with predictions for formation of an oxidized layer round an unreacted core. As formed at low temperatures the oxide has cubic symmetry (α' phase, random distribution of interstitial oxygen). On annealing at 180 to 500°, ordering takes place. Oxides UO_{2+x} ($0 < x < 0.25$) give $\alpha + \beta$ two-phase products: for $0.25 < x < 0.35$, diffraction line contours change in a manner indicating formation of β + two tetragonal phases, γ' γ''. $UO_{2.35}$ furnished nearly pure γ''. Above 450°, $\gamma'' \rightarrow \gamma' + U_3O_8$; γ' decomposes to $\beta + U_3O_8$ at high temperature. The γ' phase has $a = 5.395$, $c = 5.483$ kX, and $c/a = 1.0160$; γ'' has $a = 5.371$, $c = 5.534$ kX, and $c/a = 1.0304$. The true cell in each case probably has $a' = \sqrt{2}a$, and $c' = 2c$ with 16 U atoms. From analysis of line profiles and from the limit of oxidation of UO_2 to tetragonal oxides, tentative formulas are assigned: $\gamma' = UO_{2.312}$ or $U_{16}O_{37}$ and $\gamma'' = UO_{2.375}$ or $U_{16}O_{38}$. When oxidized particles of UO_2 are annealed, they tend to break up into fragments of the ordered intermediate phases, rather than to retain the original particle structure by diffusion and homogenization. (auth)

1252

RADIO-ISOTOPES IN AUSTRALIAN INDUSTRY AND RESEARCH. J. N. Gregory (Australian Atomic Energy Commission Research Establishment, Lucas Heights, New South Wales). p.600-6 of "Australian Atomic Energy Symposium, 1958."

A review is given of the tracer techniques now in use in Australian industry and research. The applications of radioisotopes discussed include beta-ray thickness gages, leak detection in telephone cables, underground water movement, isotope dilution techniques, monitoring power station cooling ponds, and laboratory research. (C.J.G.)

1253

NEUTRON SCATTERING TECHNIQUE FOR MEASURING WATER CONTENT OF SOILS AND OTHER MATERIALS. J. W. Holmes (Commonwealth Scientific and Industrial Research Organization, Adelaide). p.607-9 of "Australian Atomic Energy Symposium, 1958."

The technique for measuring water content by neutron scattering originally developed for soils is used to measure the water content of brown coal, and the results indicate that the calibration with this material is nearly linear, as it was for soil, though the magnitude of the slow neutron counting rate is greater than it was in soil for a given water content. Allowance was made for the hydrogen contained by the coal solids, and the difference in counting rate was related to the composition of the non-hydrogen part of the two materials, resulting in different absorption cross sections and diffusion lengths for slow neutrons. The technique measures water content by volume (gm water/cm^3). A preliminary attempt to measure the water content by weight (gm/gm) of brown coal during processing in a briquette factory proved futile due to density of the coal varying too much. (auth)

1254

MEASUREMENT OF CONCENTRATION OF TUNGSTEN SUSPENSIONS AND DENSITY OF LIQUID SODIUM BY GAMMA RAY ABSORPTION. J. S. Watt and K. R. Lawther (Australian Atomic Energy Commission Research Establishment, Lucas Heights, New South Wales). p.610-14 of "Australian Atomic Energy Symposium, 1958."

Gamma-ray absorption techniques were applied to measure the density of various media. The theory of selecting the appropriate energy gamma ray to give optimum sensitivity of density determination for a homogeneous system is outlined. A gauge to determine the concentration of tungsten powder suspended in water in a concentration range of 0 to 8 gm tungsten/cc suspension, was developed. In this apparatus the mean tungsten concentration, 0.08 gm/cc can be measured to an accuracy of approximately ±0.0015 gm/cc. In the case of liquid sodium contained in a stainless steel vessel, preliminary experiments indicate that the density may be measured to an accuracy of ±0.01 gm/cc, and that 0.01 gm/cc transient changes in density occurring in a few seconds can be resolved. (auth)

1255

THE USE OF THE ISOTOPES OXYGEN 18, CARBON 13, AND CARBON 14 IN THE STUDY OF EXCHANGE REACTIONS OF THE TRIS-OXALATO CHROMIUM III ANION. D. R. Llewellyn and A. L. Odell (Univ. of Auckland, N. Z.). p.623-7 of "Australian Atomic Energy Symposium, 1958."

1256

ELECTRON TRANSFER REACTIONS. R. W. Cattrall, J. R. McKellar, and B. O. West (Univ. of Adelaide). p.628-33 of "Australian Atomic Energy Symposium, 1958."

A brief discussion of the theories of electron transfer is given. A correlation is made between energy states in two reactants, and magnetic susceptibilities in the case of a series of cobalt and iron complexes. The Co(II) and Co(III) complexes of cyclopentadiene and of N,N′-disalicylidene-ethylenediamine are reported to undergo rapid exchange in pyridine. The cobalt acetylacetone complexes undergo slow exchange at 98°C in acetylacetone with apparent first order kinetics, $k_1 = 0.177\ hr^{-1}$ (av). Mechanisms for the exchange are discussed. (auth)

1257

THE DIFFUSION OF HYDROGEN SULPHIDE GAS THROUGH SURFACE FILMS ON WATER. J. G. Hawke (Univ. of Sydney). p.634-6 of "Australian Atomic Energy Symposium, 1958."

A new technique is described for measuring the influence of surface active compounds upon the diffusion of hydrogen sulphide from water. This involves a modified surface balance and the use of the radioactive isotope S-35 in hydrogen sulphide. The gas is trapped above the solution and its radioactivity determined continuously. The influence of the monolayer is given a precise mathematical meaning in terms of T(cm/sec), the so-called "transmission coefficient." The lower the value of T, the greater is the influence of the surface in hindering the passage of hydrogen sulphide molecules. Condensed monolayers have very much lower values of T than have liquid expanded films. The C_{22} alcohol has a lower value of T than has the C_{18} alcohol. (auth)

1258

RADIOMETRIC TITRATIONS. J. F. Duncan and F. G. Thomas (Univ. of Melbourne). p.637-43 of "Australian Atomic Energy Symposium, 1958."

The theoretical equations governing the various types of radiometric titrations are derived. They are applied to experimental results on the following systems: $(Ag^{110})\ NO_3$ titrated against KCNS, KCl, and $[Co(NH_3)_5CNS]\ (CNS)_2$; $(Co^{60})Cl_2$ titrated against Na_2WO_4; $Na_2(W^{185})O_4$ and $Na_{10}(W^{185})_{12}O_{41}$ titrated against $CuSO_4$; and nickel and lead titrated against dithizone in the presence of $(Co^{60})Cl_2$. The advantages and limitations of the method are discussed, and a continuous flow apparatus suitable for radiometric titrations (either of the precipitation or of the solvent extraction type) is presented. The method is shown to form the basis of a new technique for determining solubility products of insoluble salts. (auth)

1259

PLANT BREEDING WITH X-RAY INDUCED MUTANTS IN WESTERN AUSTRALIA. J. A. Carpenter and J. S. Gladstones (Univ. of Western Australia, Nedlands). p.648-50 of "Australian Atomic Energy Symposium, 1958."

Seeds of two annual, self-pollinating pasture species (subterranean clover and the West Australian blue lupin) were x irradiated, and some of the mutants resulting selected for use in a breeding program at the University of Western Australia. Both species will tolerate high x-ray doses, and high rates of induced mutation were obtained. Although 79 to 86% of mutants were clearly deleterious (chlorophyll deficient, dwarf, or sterile), a few were found with minor changes suitable for strain marking, and two or three with possible agronomic use (short-stemmed clover mutants, and early flowering lupin mutants). This method of increasing variability for the plant breeder should find practical application with these two species. The lupin has a narrow range of variation and adaptation in Australia, and is an unimproved crop plant, and an increased range of use may be obtained as economically as through a plant exploration, introduction and cross-breeding program. Similarly, only a narrow range of variation of the subterranean clover is available for use in the extreme environment of the drier wheatbelt, and cross-breeding is hampered by technical difficulties and interstrain sterility. In both species genetic markers for strain certification may be simply induced in new strains. (auth)

1260

THE EFFECT OF IONIZING RADIATION ON THE SYNTHESIS OF PORPHYRINS BY THE RED BLOOD CELLS OF THE DOMESTIC FOWL. R. Tirrell (New South Wales Univ. of Tech., Kensington). p.651-5 of "Australian Atomic Energy Symposium, 1958."

The effect of beta radiation on porphyrins was studied. It is shown that when a slightly alkaline solution of protoporphyrin is irradiated, the porphyrin is converted to another tetrapyrrole. Arguments are presented to support the belief that this is an oxyporphyrin. The irradiation of solutions of haemin and haemoglobin did not lead to the liberation of free protoporphyrin, thereby highlighting the stability of the Fe-pyrrole bonds of haem compounds during irradiation. The rate of synthesis of protoporphyrin by fowl erythrocytes, during the 24 hours after irradiation, is unaffected by doses to the blood of radiation up to 10,000 rads. (auth)

1261

EXPERIMENTAL HAEMATOLOGY USING Fe59 AND Cr51. Ilse Brading, E. P. George, and R. J. Walsh (St. Vincent's Hospital, Sydney). p.656-60 of "Australian Atomic Energy Symposium, 1958."

A series of experiments is discussed in which the absorption and metabolism of iron in animals and man is investigated. The results show that about 5% of the iron in meat is absorbed and utilized for red cell production in man. In the rat the proportion of iron absorbed decreases progressively as the amount administered increases, while in the rat also, denatured hemoglobin iron is absorbed more readily than native hemoglobin. In rats whose iron stores were depleted by partial hepatectomy and slenectomy, it was found that the iron deposited in the regenerating liver is derived from the circulating hemoglobin mass. Using Cr^{51}, the normal life of red cells in the rabbit was found to be 60 ± 5 days. If the red cells are treated with enzyme papain, the cell life is found to be reduced to less than 12 days. (auth)

1262

BETA-RAY THERAPY WITH STRONTIUM 90 SOURCES. D. F. Robertson (Univ. of Queensland, Australia). p.676-8 of "Australian Atomic Energy Symposium, 1958."

An assessment is made of the proven usefulness of strontium 90 as a beta-ray source in radiotherapy of the skin and the eye. The range of application of standard sources can be extended by the use of distance tubes or applicators. Preference for the various types of application is discussed in relation to measured intensities of stray radiation. (auth)

1263

EVIDENCE FOR A DIRECT MECHANISM IN LEUKAEMOGENESIS. P. L. T. Ilbery (Univ. of Sydney). p.681-4 of "Australian Atomic Energy Symposium, 1958."

Kaplan, using thymectomized, irradiated hybrid mice and grafting with a thymus of parental strain, has shown by the transplantation test that the resulting thymoma was derived from the parental strain, whose cells had not been exposed to radiation. This was the basis for the belief that the mechanism of induction of mouse leukemia was an indirect one. In preliminary experiments evidence is presented for a direct mechanism. The experiments involved the use of the T6 marker chromosome, itself produced by irradiation. When the thymectomized irradiated host contained the T6 marker, the resulting thymoma, developing in two cases of four in the grafted thymus whose cells did not bear the label, showed the marker chromosome. An interpretation of the work is given. (auth)

1264
HIGH DENSITY CONCRETE FOR RADIATION SHIELDING IN AUSTRALIA. D. Campbell-Allen (Univ. of Sydney). p.717-25 of "Australian Atomic Energy Symposium, 1958."

Aggregate selection and mix proportioning are described for concretes ranging from 150 to 350 lb per cu ft in density. Laboratory and field tests were made for concrete used in the construction of a reactor, and some economical alternatives were examined in the laboratory. For concrete density over 300 lb per cu ft, steel aggregates are required. For concrete density between 200 and 250 lb per cu ft, iron ore is attractive but requires further investigation. Ilmenite proved a useful fine aggregate for all high density concrete. (auth)

1265
REACTOR IRRADIATION TECHNIQUES. B. S. Hickman (Australian Atomic Energy Commission Research Establishment, Lucas Heights, New South Wales). p.726-30 of "Australian Atomic Energy Symposium, 1958."

The problems encountered in carrying out precise investigations of the effects of neutron irradiation on the properties of materials are discussed. Various experimental techniques which were developed to overcome these problems are described with particular reference to techniques which could be used in research reactor, HIFAR. (auth)

1266
THE DEVELOPMENT OF RADIOCHEMICAL FACILITIES AT LUCAS HEIGHTS. G. L. Miles and D. P. Sangster (Australian Atomic Energy Commission Research Establishment, Lucas Heights, New South Wales). p.731-8 of "Australian Atomic Energy Symposium, 1958."

A description is given of the radiochemical laboratories at Lucas Heights. Design problems, experimental facilities, and initial operating experience are discussed. (auth)

1267
ANALYTICAL CHEMISTRY IN ATOMIC ENERGY. L. E. Smythe (Australian Atomic Energy Commission Research Establishment, Lucas Heights, New South Wales). p.739-43 of "Australian Atomic Energy Symposium, 1958."

The requirements for analytical chemistry in atomic energy are outlined and the impact of increasing instrumentation is discussed. Some recent developments in analytical chemistry instrumentation are reviewed and their possibilities and uses in the atomic energy field are assessed. These include automatic coulometry, square wave polarography, gamma spectrometry, low background beta counting, infra-red spectrometry, mass spectrometry, emission spectrography, x-ray spectrography, and vacuum fusion analysis. (auth)

1268
THE TURBINE ENGINEERING LABORATORY AT THE UNIVERSITY OF SYDNEY. G. G. McDonald (Univ. of Sydney). p.745-9 of "Australian Atomic Energy Symposium, 1958."

A description is given of laboratory equipment constructed from parts of a number of obsolete Boeing 22 G.E.C. turbo-superchargers. A range of 21 units covering radial and impulse water, gas, air, and steam turbines, fans and blowers, and also dynamometers are listed under six test facilities which form the basis of the practical program of training undergraduate and post-graduate students at the University of Sydney. (auth)

1269
PROGRAM OF EDUCATION FOR NUCLEAR ENGINEERING, SCIENCE AT THE N.S.W. UNIVERSITY OF TECHNOLOGY. J. H. Green and L. C. Woods (New South Wales Univ. of Tech., Kensington). p.750-4 of "Australian Atomic Energy Symposium, 1958."

A description is given of past courses and those to be offered in the future on nuclear engineering, isotopes applications, and reactor materials (fuels and structural materials). (C.J.G.)

1270
CONTROLLED THERMONUCLEAR REACTIONS. T. E. Allibone (Associated Electrical Industries, Ltd., Aldermaston, Berks, Eng.). p.758-64 of "Australian Atomic Energy Symposium, 1958."

Starting with early experiments on the thermonuclear reaction in deuterium, a review is given of succeeding experiments on pinched discharges. A discussion is given on the use of the large torus ZETA and the smaller torus SCEPTRE. (C.J.G.)

1271
SOME ASPECTS OF PROJECT SHERWOOD, THE U.S.A.E.C. PROGRAM ON CONTROLLED THERMONUCLEAR POWER. A. E. Ruark (U. S. Atomic Energy Commission, Washington, D. C.). p.765-73 of "Australian Atomic Energy Symposium, 1958."

The goals of project Sherwood are to bring plasma to the so-called ignition temperature, to obtain a device which produces ionized plasmas and yields a net power, and to make an economic power producer. Discussions are given on the motion of charged particles in a uniform magnetic field, fusion reactions, charge exchange, and plasma instabilities. The methods employed in magnetic mirrors, stellarators, and the Luce ignition and pinch effect devices for producing controlled thermonuclear power are compared. (C.J.G.)

BIOLOGY AND MEDICINE

General and Miscellaneous

1272 AECU-4327
Massachusetts Inst. of Tech., Cambridge.
EXPANDING THE UTILIZATION OF RADIOISOTOPES AND NUCLEAR TECHNIQUES IN FOOD TOXICOLOGY AND PROCESSING. John H. Rust. Nov. 1959. 62p. Contract AT(30-1)-2309. OTS.

Areas in the field of food technology in which radioisotopes and nuclear techniques may be used to advantage are reviewed. A general estimate is presented of the scientific and physical capabilities of the food industry in the special areas of chemical and biochemical food toxicology and associated food processing problems. Since the industry is faced with a new and enormous task in food toxicology, the role that radioisotopes and nuclear techniques can play is a prime consideration. Recommendations for action and an estimate of the cost of a research program are included. Appended are several pertinent discussions covering the present situation, the potential of tracer methods for food toxicology, possible areas of study, development of a labeled compound program, training and education, the tritiation of food additives, an evaluation of the carbon-14 recoil method of labeling organic substances, applications of radioactive tracers in the study of food additives, and a list of government agencies interested in the field of food technology. (C.H.)

1273 AECU-4414
Du Pont de Nemours (E. I.) & Co. Savannah River Plant, Aiken, S. C.
A NEW PROCEDURE FOR PLUTONIUM URINALYSIS. Sarah C. Leidt and S. Marshall Sanders, Jr. July 1959. 35p. Contract AT(07-2)-1. (DPSPU-59-30-8A). OTS.

Presented at the Fifth Annual Meeting on Bio-assay and Analytical Chemistry, Gatlinburg, Tennessee, October 1959.

In the new procedure urine is evaporated and wet ashed, and plutonium is separated from macroquantities of other inorganic ions by anion exchange and then electrodeposited on a stainless steel disk. The amount of plutonium present is determined by autoradiographing and track-counting. The additional sensitivity in the track-counting procedure allows the amount of urine analyzed to be reduced from 1500 ml to 250 ml. The greater simplicity of the procedure, which requires only two transfers, allows the analysis to be done in a maximum of only two days. Recovery of plutonium by this method using a 0.88 d/m/1.5 ℓ spike is 74% with ±23% representing the 95% confidence interval. Its limit of sensitivity is considered to be 0.05 d/m/1.5 liters of urine. (auth)

1274 UCRL-8870
California. Univ., Berkeley. Lawrence Radiation Lab.
RESEARCH IN PHOTOSYNTHESIS. PART I. BIOSYNTHETIC STUDIES ON THE CHLOROPHYLLS AND CAROTENOIDS OF ALGAE. PART II. THE RELATION OF BRANCHED-CHAIN SUGAR ACIDS TO THE CYANIDE INHIBITION OF CO_2 FIXATION (thesis). Joan Mary Anderson. Sept. 1959. 161p. Contract W-7405-eng-48. OTS.

The determination of the specific radioactivities of the chlorophylls and carotenoids of algae after photosynthesis with $C^{14}O_2$ is a formidable task, due to the extreme lability of these compounds. The whole success of the method depends on adequate chromatographic separations of the pigments from the colorless contaminants which are closely associated with them, and yet the time involved for such separations is sufficient for marked decomposition of the pigments to occur. It is suggested that the techniques of column chromatography, followed by centrifugally-accelerated paper chromatography of the spectroscopically pure pigments, may resolve this problem. In an investigation of the action of cyanide on photosynthesis, green algae have been treated with radioactive cyanide. A multitude of products have been found to be formed in very short exposure times. One of these was identified with a material formed when algae are given radioactive CO_2 and non-radioactive KCN. This material has been identified as the cyanide addition product of ribulose-1,5-diphosphate. Upon hydrolysis it gives a branched-chain sugar acid (or mixture of isomers) closely related to hamamelonic acid. Perhaps the most important aspect of this work is the demonstration of the chemical role of cyanide. (auth)

1275 AEC-tr-3878
PHYSICOCHEMICAL STATE OF PLUTONIUM (Pu^{239}) IN BLOOD AFTER ITS INTRAVENOUS ADMINISTRATION. Yu. A. Beliayev. Translated by Lydia Venters (Argonne National Lab.) from Med. Radiol. 4, No. 9, 45-51(1959). 9p. JCL or LC.

The content of plutonium in blood at different time periods after an intravenous introduction in the form of a simple salt such as nitrate, and citrate complex is different. In the last case the increased concentration of plutonium is maintained for a more prolonged time. Tetravalent plutonium is transported by blood chiefly in the form of protein complexes. Approximately 10% of plutonium in blood is in an ionogenic state. These ions are charged negatively. In the blood plasma the content of plutonium is five times higher than in the cellular elements. This ratio changes slightly with time. (auth)

1276 JPRS-tr-L-576-N
EXPERIMENTAL INSTALLATION FOR IRRADIATION OF ANIMALS BY NEUTRON FLUXES (ENO-1), REPORT I. A. G. Istomina and I. B. Keirim-Markus. Translated from Med. Radiol. 3, No. 3, 51-61(1958). 13p. OTS.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 14166.

1277 JPRS(NY)-899
RADIOBIOLOGY IN THE USSR. Translation of Abstracts of Articles from Selected Soviet Periodicals. 19p. OTS.

Abstracts are presented of articles from selected Soviet periodicals dealing with applications of radiation and radioisotopes in biology and medicine. Topics covered include hematological research, the effect of hypothermy on the living organism, a tracer study of the role of chemosynthesis in the production of silt deposits and bacterial slimes in reservoirs, the metabolism of strontium-89 in rats, and various other tracer studies on metabolism in rats. (C.H.)

1278
EFFECT OF D_2O IN VIVO AND IN VITRO ON UPTAKE OF p-AMINOHIPPURATE BY RAT KIDNEY SLICES. John F. Thomson and Florence J. Klipfel (Argonne National Lab., Lemont, Ill.). Am. J. Physiol. 197, 1128-30(1959) Nov.

Kidney slices from rats in which one-third of the body water was replaced by D_2O showed no impairment of the capacity to accumulate PAH, despite the moribund condition of the animals. In vitro, 100% D_2O inhibited PAH uptake by 65%, oxygen consumption by only 15%, during a 1-hour incubation of kidney slices; very little PAH was taken up after the first 30 minutes. (auth)

1279
RECENT DEVELOPMENTS IN RADIOISOTOPE TECHNIQUES: A SYMPOSIUM. I. CYCLOTRON-PRODUCED ISOTOPES IN CLINICAL AND EXPERIMENTAL MEDICINE. G. R. Newbery (Hammersmith Hospital, London). Brit. J. Radiol. 32, 633-41(1959) Oct.

Data are tabulated on cyclotron-produced isotopes of medical and biological interest. Advantages of cyclotron-produced radioisotopes are discussed. Applications in medical studies are reviewed. (C.H.)

1280
SUMMARY REPORT AND PROCEEDINGS OF THE FOOD AND AGRICULTURE ORGANIZATION EUROPEAN MEETING ON THE USE OF IONIZING RADIATIONS FOR FOOD PRESERVATION, HARWELL, ENGLAND, NOVEMBER 17–21, 1958. Intern. J. Appl. Radiation and Isotopes 6, 1-317(1959) Oct.

A summary report and proceedings are presented of the European Meeting on the use of Ionizing Radiation for Food Preservation, held at Harwell, England, November 1958. Separate abstracts are presented for 39 papers. (C.H.)

1281
EFFECTS OF RADIATIONS ON AQUEOUS SYSTEMS UNDER AEROBIC AND ANAEROBIC CONDITIONS. J. Weiss (Univ. of Durham, Eng.). Intern. J. Appl. Radiation and Isotopes 6, 52-8(1959) Oct.

It is known that the chemical changes induced by ionizing radiations are, in general, considerably influenced by the presence of oxygen. It has been shown, that the presence of oxygen is not only capable of increasing the extent of radiation-induced oxidations but, in many cases, also leads to a qualitative difference in the nature of the radiation products. In particular, it has been found that in the presence of oxygen, more or less stable hydroperoxides are produced from various compounds, including many substances which occur in biological materials. (auth)

1282

SOME ASPECTS OF RADIATION-INDUCED FREE RADICAL REACTIONS AND THE SIGNIFICANCE OF FREE RADICAL ACCEPTORS. N. Uri (Ministry of Agriculture, Aberdeen, Scotland). Intern. J. Appl. Radiation and Isotopes 6, 59-68(1959) Oct.

The exact nature of the radiation—chemical primary act is controversial but there is little doubt that a major role is played by secondary reactions in which free radicals participate. Some of the most undesirable side effects in food irradiation would be produced by free radicals, particularly when they can cause a chain reaction. The study of radiation-induced oxidative rancidity, which is a chain reaction, and its inhibition by free radical acceptors is, therefore, both of fundamental and of practical importance. In order to reach the backbone of the mechanism it is advantageous to work with pure linoleic acid and its esters. Some protection against radiation effects can be achieved by energy transfer, but this mode of action could not be efficient once free radicals are formed. A detailed study of free radical acceptors is, therefore, necessary. Some of their essential properties are outlined and a comparison is made between their efficiency in thermal oxidative rancidity and radiation-induced oxidative rancidity. This outline includes newly synthesized polyhydroxyflavones and special emphasis is placed on the apparent significance of amino derivatives. The importance of dose rate is also indicated and application to milk is mentioned. Finally, the concept of radio-antibiotics is introduced and the prospects of efficient free radical acceptors are summarized. (auth)

1283

FREE RADICAL INVESTIGATIONS IN THE UNITED STATES. G. Tripp (Quartermaster Food and Container Inst. for the Armed Forces, Chicago). Intern. J. Appl. Radiation and Isotopes 6, 69(1959) Oct.

A brief summary is presented of results from studies on free radical formation, types of radicals formed, and the ultimate fate of free radicals in irradiated foods as determined by paramagnetic resonance. These studies were conducted with dry foods, moist foods at ambient conditions, and frozen moist foods. Results are also summarized from studies to determine if the effects of free radicals may be minimized through use of free radical acceptors. (C.H.)

1284

CHEMICAL CHANGES PRODUCED IN LIPIDS BY IRRADIATION. B. Coleby (Low Temperature Station for Research in Biochemistry and Biophysics, Cambridge, Eng.). Intern. J. Appl. Radiation and Isotopes 6, 71-5(1959) Oct.

Irradiation gives rise to off-flavors in lipids which, with some foods, are a serious disadvantage. The off-flavors show a resemblance to those encountered in oxidative rancidity, and experiments with model systems have shown that the course of reactions is somewhat similar in the two cases, i.e., hydroperoxides and carbonyl compounds are formed. Usually, the molecule is attacked in a limited number of places; and this has also been observed with some phospholipids. Removal of oxygen during irradiation and storage prevents some, but not all, of the changes. Antioxidants present in natural lipids can profoundly influence the reactions, and the physical state of the lipid, determined by temperature, can play an important role during both irradiation and subsequent storage. (auth)

1285

THE EFFECTS OF RADIATION ON PROTEINS. B. S. Schweigert (American Meat Inst. Foundation, Chicago and Univ. of Chicago). Intern. J. Appl. Radiation and Isotopes 6, 76-7(1959) Oct.

Major chemical changes induced by radiation on proteins include denaturation, degradation, and polymerization. The allergenicity of proteins has been shown to be particularly sensitive to irradiation. One of the primary changes noted after the irradiation of proteins is their marked sensitivity to temperature changes of the stored solutions. The influence of radiation-induced changes in proteins on changes in irradiated foods is discussed briefly. (C.H.)

1286

THE CHEMICAL ACTION OF GAMMA RADIATION ON AQUEOUS SOLUTIONS OF CARBOHYDRATES. G. O. Phillips and G. J. Moody (University College, Cardiff, Wales). Intern. J. Appl. Radiation and Isotopes 6, 78-85 (1959) Oct.

Using paper chromatographic and radioactive tracer methods, the products formed when aqueous solutions of carbohydrates are irradiated with ionizing radiations are identified and quantitatively estimated. In dilute aqueous solutions D-glucose is degraded to D-glucuronic acid, D-gluconic acid, glyoxal, D-arabinose, D-erythrose, formaldehyde, saccharic acid and 1 : 3-dihydroxyacetone, which have been estimated quantitatively. By following the yield—dose curves for the main products, the primary and secondary products are distinguished, and the main types of degradation identified. The main products formed during the irradiation of aqueous dextran solutions are glucose, isomaltose, isomaltotriose, gluconic acid, glucuronic acid, glyoxal, erythrose, and glyceraldehyde. These products are considered to arise from at least two independent processes. The main attack when D-sorbitol solutions are irradiated with γ-rays is located at the primary alcohol groups in the molecule. The primary products are D-glucose and L-gulose, and appreciable amounts of D-arabinose and L-xylose were formed by secondary attack. A possible mechanism for the process is suggested. (auth)

1287

CHEMICAL CHANGES IN STORED FOODS WHEN MICROBIAL SPOILAGE IS NOT LIMITING. C. H. Lea (Low Temperature Research Station, Cambridge, Eng.). Intern. J. Appl. Radiation and Isotopes 6, 86-94(1959) Oct.

The application of ionizing radiations to foods normally subject to rapid microbial spoilage can raise new problems, both by giving time for slower enzymic or chemical changes to assume significance and by accelerating some of the known processes of chemical deterioration. These factors are considered with particular reference to nonenzymic browning and lipid oxidations. (auth)

1288

FUNDAMENTAL RADIOBIOLOGY. H. Laser (Medical Research Council, Molteno Inst., Cambridge, Eng.). Intern. J. Appl. Radiation and Isotopes 6, 96-9(1959) Oct.

Food sterilization by ionizing radiations is dependent on our knowledge of the basic effects of these radiations on microorganisms, the growth of which it is intended to suppress, and on many components of the biological material itself. A few examples pertaining to each class are given, demonstrating how changing conditions prior to or during irradiation, including variations of oxygen tension, affect radiosensitivity. (auth)

1289

RADIATION MICROBIOLOGY AS APPLIED TO FOODS. T. Horne and B. A. Bridges (Wantage Radiation Lab., Eng.). Intern. J. Appl. Radiation and Isotopes 6, 100-4 (1959) Oct.

There is no such thing as a predictable inactivation dose which will just kill off with 100 per cent certainty, all the microorganisms in a given sample. The inactivation of most species of microorganisms by ionizing radiation is approximately an exponential process and doses suitable for sterilizing foodstuffs must be calculated with this fact in mind. It is shown that, assuming a standard of sterility of 10^{-8} organisms/g, a safe sterilizing dose will be of the order of 3 to 5 Mrads according to the initial concentration of microorganisms. The effect during irradiation of certain environmental factors such as pH, freezing, heating, additives, etc., is discussed in relation to food processing and stress is laid on the fact that we still know comparatively little about post-irradiation effects. Because of the undesirable quality changes in most foods after 3 to 5 Mrads of ionizing radiation, it is suggested that low dose and combination procedures might prove more practicable. There is still need for many more fundamental microbiological studies before progress can be made on a large scale. (auth)

1290

COMBINATION PROCESSES. M. Ingram (Low Temperature Station for Research in Biochemistry and Biophysics, Cambridge, Eng.). Intern. J. Appl. Radiation and Isotopes 6, 105-9(1959) Oct.

Combination processes are here regarded as those whose influence is exerted primarily during the period after irradiation. Refrigeration, vacuum-packing, addition of antibiotics, curing, and heating are considered. The first three do not change the state of raw foods. The value of refrigeration, besides the general slowing down of enzymic, chemical, and microbiological changes, is that temperatures below 5°C prevent the development of food poisoning organisms, hence chilling seems necessary to supplement a process of radiation pasteurization which might allow them to survive. Vacuum-packing, and antibiotics, though they further prolong the storage life of irradiated foods, can also not be relied on to inhibit pathogens, so that refrigeration is desirable when using these processes too. Some cured products resist high doses of radiation and can thus be sterilized, but others are more susceptible and tolerate only small pasteurizing doses. There might apparently be a hazard from staphylococci. The combination of heating and radiation for sterilization is interesting because irradiation might replace part of the often excessive heat treatments given to canned foods. Even short of sterilization, irradiation should confer a high degree of stability on cooked foods, though sporing anaerobes would be likely to survive, making refrigeration again desirable. The consumer is by experience well acquainted with the usual signs of microbial spoilage in foods. Unfortunately, radiation pasteurized foods often lack these well-known warning signals. (auth)

1291

SUMMARY OF RECENT MICROBIOLOGICAL STUDIES IN THE U.S.A. H. F. Kraybill (Army Medical Research and Nutrition Lab., Denver). Intern. J. Appl. Radiation and Isotopes 6, 110(1959) Oct.

The use is reported of a non-pathogenic indicator organism for determination of the radioresistant properties of bacterial survivors in irradiated foods. The concept is presented that the high dosage of 4.5 Mrads may not be required for Clostridium batulinum as previously suggested for all foods, since acid foods may require a much lower dose. (C.H.)

1292

THE EFFECTS OF IRRADIATION ON THE QUALITY OF MEAT AND POULTRY. B. Coleby (Low Temperature Station for Research in Biochemistry and Biophysics, Cambridge, Eng.). Intern. J. Appl. Radiation and Isotopes 6, 115-21(1959) Oct.

Although different meats vary considerably in their response to irradiation, the changes in color, odor, and flavor produced with sterilizing doses are usually sufficiently pronounced to render the process of doubtful commercial value. Pasteurizing doses of radiation appreciably extend the time required for microbial spoilage of meats under chilled storage, and in many cases, such doses produce little or no off-flavors. With both high and low dose treatments, the chemical and physical environment of the meat has an important influence on these adverse changes, and the effects of removing oxygen and freezing are discussed. Storage of irradiated meats usually results in a further loss of quality. With sterilized meats this proceeds more rapidly at high temperatures, and with pasteurized meats, flavor deterioration is often noticeable before microbial spoilage occurs. In many cases, this deterioration is due to oxidative rancidity of lipids, but this is not always the explanation. Pasteurization processes appear to give a small net increase in the period for which meats of high quality can be stored under chilled conditions. (auth)

1293

CHANGES IN SPOILAGE PATTERN OF CHICKEN MEAT AS A RESULT OF IRRADIATION. M. Ingram and Margaret J. Thornley (Low Temperature Station for Research in Biochemistry and Biophysics, Cambridge, Eng.). Intern. J. Appl. Radiation and Isotopes 6, 122-8(1959) Oct.

The microflora of radiation-pasteurized chicken meat is described in detail. With anaerobic minced meat kept at 5°C, doses of 0.25 Mrad delayed spoilage for several weeks. The ultimate spoilage flora consisted of microbacteria and faecal streptococci. The enrichment of the latter raises misgivings about this type of process. With whole eviscerated chickens, stored at 1 to 3°C in loose film bags, doses up to 0.8 Mrad increased the storage life roughly from 10 to 50 days. The spoilage microflora was somewhat different in different experiments, and corresponding differences were observed in the off-odors which heralded spoilage. In all cases, however, the principal organisms were bacteria of types common on chilled meat. It is concluded that there are no special bacteriological indications against radiation pasteurized meats, provided they are packed in air and kept at chill temperatures. (auth)

1294

IRRADIATION OF FOOD IN RELATION TO OTHER PROCEDURES FOR PRESERVATION, PARTICULARLY THE INHIBITION OF ENZYMATIC AUTOLYSIS BY ADRENALINE. C. Radouco-Thomas (Medical School, Birmingham, Eng.). Intern. J. Appl. Radiation and Isotopes 6, 129-36(1959) Oct. (In French)

Spoilage of meat is closely associated with autolysis and microbial development. This paper describes a new process for the better preservation of meat by combining an epinephrine anti-autolytic treatment with irradiation as an anti-microbial treatment. The anti-autolytic effect is produced by ante-mortem administration of epinephrine. Samples of muscular tissues from small and large animals (rats, rabbits, chickens, pigs, lambs, and beef animals) have been studied immediately post-mortem and also after storage for periods up to several weeks at various temperatures (4, 25, and 38°C). Modifications in the biochemical, structural, and organoleptic characteristics of epinephrine treated muscles are shown by a considerable reduction in the exudation of muscular tissue fluids and in the structural breakdown of the muscular tissue. Moreover, the characteristic post-mortem fall in pH of the muscular tissue is inhibited and the organoleptic qualities of meat (and especially tenderness) are maintained or improved. Combined treatments (epinephrine/irradiation) have given good results with pig meat, beef, and poultry meat and, it seems, do not cause the meat to be unfit for human consumption. Such a combination process in conjunction with suitable protective packaging materials offers the possibility of better storage properties in the treated meat when held at freezing or atmospheric temperatures. The question of surface irradiation only or penetrating radiation is bound up with the problem of muscle sterility. (auth)

1295

THE PRESENT STATUS OF IRRADIATION OF FOODS IN THE U.S.A.—MEAT, POULTRY AND FISH. B. S. Schweigert (American Meat Inst. Foundation, Chicago and Univ. of Chicago). Intern. J. Appl. Radiation and Isotopes 6, 137-8(1959) Oct.

The present status of radiosterilization of foods in the United States is reviewed briefly. (C.H.)

1296

THE PRESENT STATUS OF RADIATION PRESERVATION OF MEAT AND MEAT PRODUCTS. E. Stenberg Knudsen (Danish Meat Research Inst., Roskilde, Denmark). Intern. J. Appl. Radiation and Isotopes 6, 139-42(1959) Oct.

A brief account on the current methods of meat preservation is given in connection with an evaluation of radiation preservation of meat. A conclusion is that it would not be feasible to replace the current preservation methods by irradiation. But there seems to be some advantage in combining radiation treatment with cooling to prolong the storage life of the products. And in the same way it seems to be feasible to combine the ordinary heat preservation with a radiation preservation to achieve a meat-preserve with good keeping quality and improved texture. The possibility of applying radiation as a preservation technique to prepacked meat products is mentioned. (auth)

1297

THE PRESENT STATUS OF RADIATION PRESERVATION OF FOOD PRODUCTS—FISH. J. M. Shewan (Torry Research Station, Aberdeen, Scotland). Intern. J. Appl. Radiation and Isotopes 6, 143-6(1959) Oct.

The sterilization of the commoner varieties of sea foods by irradiation requires doses which almost invariably produce undesirable and unacceptable organoleptic changes in these products. It seems unlikely, therefore, that this method can at present compete commercially with the more conventional preservation processes. Recent work suggests that pasteurizing doses either alone or along with a variety of combination treatments, could give satisfactory products with greatly enhanced shelf life particularly at chill temperatures. Of over 20 species of fish tested, cod and halibut stand up best organoleptically. In fatty fish, such as herring, rancidity of the oil is an added hazard, while in other species like salmon, the pigment is bleached or in white fleshed species, brown discolorations appear. On the other hand, blanched oysters and cooked crab and shrimp meats stand up well with great improvements in their keeping qualities. Provided the more obvious defects in the present process can be overcome, it seems likely that this new technique could revolutionize the present methods of marketing unfrozen fish to inland populations far from the ports. (auth)

1298

IRRADIATION OF EGGS AND EGG PRODUCTS. J. Brooks (Low Temperature Station for Research in Biochemistry and Biophysics, Cambridge, Eng.), R. S. Hannan (Low Temperature Station, Cambridge, Eng.) and Betty C. Hobbs (Central Public Health Lab., London). Intern. J. Appl. Radiation and Isotopes 6, 149-54(1959) Oct.

It has been known for some time that egg products may contain members of the Salmonella group capable of causing food poisoning, and the position has been rendered more serious by the recent discovery of S. paratyphi B in some of the samples of egg products. Attempts to destroy salmonellae in liquid egg by pasteurization before freezing or drying have met with considerable success but the process requires careful control. The tins in which the frozen product is distributed hold up to 20 kg, and are therefore of a size suitable for treatment with γ-radiation. After treatment of small samples of frozen whole egg with 2 Mev cathode rays it was concluded that a dose of about 0.3 to 0.5 Mrad would destroy the numbers of salmonellae normally encountered in the product without impairing the baking qualities of the material. Whole tins, each containing 10 kg of infected material, were therefore irradiated in the frozen state with Co^{60} γ-rays. Two tins were treated at each of three dose levels of 0.3, 0.4, and 0.5 Mrad. No salmonellae were detected in duplicate samples of 25 g of material taken from each of the tins after irradiation. If the effectiveness of the treatment is confirmed, the process has obvious attractions since it dispenses with the need to thaw or otherwise to handle the product. The paper also contains a general discussion on the irradiation of eggs and egg products. (auth)

1299

THE PRESENT STATUS OF THE IRRADIATION OF FOODS IN THE U.S.A.—EGGS. B. S. Schweigert (American Meat Inst. Foundation, Chicago and Univ. of Chicago). Intern. J. Appl. Radiation and Isotopes 6, 155(1959) Oct.

Flavor changes were observed in irradiated scrambled eggs with dosages of 1.3 Mrad. Spray-drying eggs after irradiation successfully eliminated any significant flavor differences attributable to irradiation. Doses of 0.125 to 0.6 Mrad destroyed salmonella present in the eggs. It is concluded that irradiation has little application for the preservation of fresh eggs, but may have some application in prepared products. (C.H.)

1300

SOME EFFECTS OF IONIZING RADIATIONS ON LIQUID WHOLE MILK AND WHEY PROTEIN. G. Glew (Wantage Radiation Lab., Eng.). Intern. J. Appl. Radiation and Isotopes 6, 156-9(1959) Oct.

Liquid whole milk was irradiated, and changes in flavor, alkaline phosphatase activity, and acid soluble nitrogen were examined. Radiation induced flavor changes became detectable at 20,000 rads whereas 25 Mrads were required to inactivate the enzyme alkaline phosphatase. Preliminary experiments on the effects of combined heat and radiation treatment on phosphatase activity are described. Increased u.v. absorption of irradiated solutions of β-lactoglobulin and radiation induced changes in the electrophoretic behavior of whey proteins were studied. (auth)

1301

BACTERIOLOGICAL INVESTIGATION OF LIQUID MILK IRRADIATED IN GAMMA-SOURCE. Barbara M. Freeman (Wantage Radiation Lab., Eng.). Intern. J. Appl. Radiation and Isotopes 6, 160-3(1959) Oct.

The effect of irradiation of liquid milk on the bacterial flora is discussed. Marked reductions in the total counts and coliform counts is shown at varying dose levels. Spore-formers surviving irradiation treatment increased during the storage period and appeared between the fourth and eleventh days after irradiation. The occasional odd colonies appearing after the higher irradiation doses could not be classified as truly resistant organisms. (auth)

1302

THE PRESENT STATUS OF IRRADIATION OF FOODS IN THE U.S.A.—MILK AND MILK PRODUCTS. B. S. Schweigert (American Meat Inst. Foundation, Chicago and Univ. of Chicago). Intern. J. Appl. Radiation and Isotopes 6, 164-5(1959) Oct.

Milk is one of the most sensitive of all foods to flavor and odor changes that occur during irradiation. Work in eliminating the off-flavor constituents from milk and milk products during irradiation is reviewed. (C.H.)

1303

THE IRRADIATION OF WARE POTATOES. W. G. Burton (Ditton Lab., Larkfield, Eng.) and W. H. de Jong (Inst. for Storage and Processing of Agricultural Products, Wageningen, Netherlands). Intern. J. Appl. Radiation and Isotopes 6, 167-70(1959) Oct.

Gamma-irradiation at 10,000 rads or even less will prevent the sprouting of potatoes, and its use on the commercial scale appears to be technically feasible. Its widespread employment on individual farms would perhaps be difficult and it has other disadvantages. For instance it may increase fungal rotting, and it accelerates the sweetening and tissue breakdown which normally occur after prolonged storage. (auth)

1304

IRRADIATION OF ROOT CROPS. Knut Mikaelsen (Agricultural Coll. of Norway, Inst. of Genetics, Vollebekk). Intern. J. Appl. Radiation and Isotopes 6, 171-3(1959) Oct.

Moderate doses of γ radiation seem to be effective in preventing or inhibiting sprouting, growth, and weight loss in various root crops, but the incidence of rotting seems to be a serious problem in irradiated material. The experimental results seem to indicate that radiation treatment increases the susceptibility to rot infections. This problem seems to be solved in carrots, where minimum rot development was obtained when washed and clean roots were irradiated and stored in plastic bags and kept at cool storage temperatures. (auth)

1305

POTATOES AND ROOT CROPS. G. Tripp (Quartermaster Food and Container Inst. for the Armed Forces, Chicago). Intern. J. Appl. Radiation and Isotopes 6, 174(1959) Oct.

Irradiation of potatoes has proved a practical means of prolonging storage life. Work on the effects of radiation on onions is reported in progress. (C.H.)

1306

POSSIBLE APPLICATIONS OF IONIZING RADIATIONS IN THE FRUIT, VEGETABLE AND RELATED INDUSTRIES. I. D. Clarke (Wantage Radiation Lab., Eng.). Intern. J. Appl. Radiation and Isotopes 6, 175-81(1959) Oct.

Some effects of γ radiation have been observed on the texture, flavor, and processing properties of fruits and vegetables. An appreciable reduction in mold decay of strawberries during storage at 20 and 1°C has been observed after treatment with 0.2 to 0.4 Mrad. Flavor was affected slightly and the viscosity of the juice was reduced considerably. The viscosity of juice extracted from irradiated whole berries, was reduced considerably by doses between 0.4 and 0.6 Mrad without critically affecting the flavor of the juice. The irradiated berries were free from a significant number of mold spores. No immediate commercial application was foreseen in the black currant juice industry. Plums were shown to be free from mold after a treatment of 0.4 Mrad and the initial spore count of apples is considerably reduced by a dose of 0.2 Mrad. Some evidence has been obtained that the softening of pears can be delayed by a dose of 0.3 and 0.5 Mrad. The published literature on the effects of radiation on other fruits and vegetables has been reviewed and commented upon. (auth)

1307

FRESH FRUITS AND VEGETABLES. G. Tripp (Quartermaster Food and Container Inst. for the Armed Forces, Chicago). Intern. J. Appl. Radiation and Isotopes 6, 182 (1959) Oct.

Various aspects of fruit and vegetable irradiation are reviewed briefly. (C.H.)

1308

THE EFFECT OF IONIZING RADIATION ON PARASITES, OR DESTRUCTION OF TRICHINA IN PORK CARCASSES. H. F. Kraybill (Army Medical Research and Nutrition Lab., Denver). Intern. J. Appl. Radiation and Isotopes 6, 185-6(1959) Oct.

Measures are discussed for the elimination of trichinal and ultimately trichinosis by irradiation of pork. (C.H.)

1309

THE EFFECT OF IONIZING RADIATION ON INSECTS. H. F. Kraybill (Army Medical Research and Nutrition Lab., Denver). Intern. J. Appl. Radiation and Isotopes 6, 187(1959) Oct.

Methods are outlined for the elimination of insects from grain and foods by exposure to ionizing radiation. (C.H.)

1310

THE DISINFESTATION OF FOODS, PARTICULARLY GRAIN. P. B. Cornwell (Wantage Radiation Lab., Eng.). Intern. J. Appl. Radiation and Isotopes 6, 188-93(1959) Oct.

There are two potential methods of controlling insect pests by irradiation; indirect control by the release of sterilized adults and the direct treatment of infested products. Application of the first method is limited to certain species by a number of biological and environmental factors. The second method could have wider application for the control of all species infesting stored materials. Among the factors which may influence its success, problems associated with bulk handling and the incorporation of treatment into established handling procedures, must receive primary consideration. These could be most easily solved in the treatment of packaged goods where production and irradiation may be carefully integrated. (auth)

1311

DESTRUCTION BY IRRADIATION OF PARASITES TRANSMITTED TO MAN THROUGH BUTCHERS' MEAT. E. L. Taylor and J. W. Parfitt (Central Veterinary Lab., Weybridge, Eng.). Intern. J. Appl. Radiation and Isotopes 6, 194-8(1959) Oct.

Meat inspection methods have greatly reduced the risk of the transmission of parasites to man through the consumption of butchers' meat; three parasitic worms still remain, however, in developed countires, Cysticercus bovis, Echinococcus granulosus, and Trichinella spiralis. The incidence of these three has reached a low level but present methods are inadequate to reduce it further. Observations show that doses up to 100 krads do not kill the larvae of Trichinella, nor do they kill Cysticercus. These immature stages are, however, rendered incapable of development when transferred to suitable hosts, the inhibitory effects being observable at exposures as low as 10 krads.

It is concluded that the development of suitable methods for applying the treatment coupled with the increased centralization of slaughter might bring about the eradication of C. bovis and T. spiralis, although E. granulosus is likely to remain for a longer period. (auth)

1312

PACKAGING FOR IRRADIATED FOODS. G. E. Tripp (Quartermaster Food and Container Inst. for the Armed Forces, Chicago). Intern. J. Appl. Radiation and Isotopes 6, 199-206(1959) Oct.

Packages for irradiated foods must be compatible with the radiation treatment, the food, and the production line. In the case of foods treated by radiation doses of 1 Mrad, or less, common commercial packages appear satisfactory. Radiation doses of more than 1 Mrad have an adverse effect on packages and care must be taken in selecting packages for foods to be treated by radiation doses in excess of 1 Mrad. (auth)

1313

THE ECONOMICS OF MACHINE SOURCES OF RADIATION. M. C. Crowley-Milling (Metropolitan-Vickers Electrical Co. Ltd., Manchester, Eng.). Intern. J. Appl. Radiation and Isotopes 6, 207-10(1959) Oct.

The correlation between size and cost of existing electron accelerators for food processing is examined. The possible efficiency of utilization is discussed and a table gives expected costs for a number of applications. A sketch shows an installation suitable for treating boxes on a conveyor system. (auth)

1314

ECONOMICS OF GAMMA RADIATION PROCESSING. G. S. Murray (Wantage Radiation Lab., Eng.). Intern. J. Appl. Radiation and Isotopes 6, 211-15(1959) Oct.

The availability, cost and, utilization of γ-radiation sources for food processing are discussed. The effects on radiation processing costs of variations in these factors and in the scale of operation are considered. It is concluded that probable costs do not preclude immediate applications if plant is efficiently designed and processing is on a sufficiently large scale. (auth)

1315

ECONOMIC CONSIDERATIONS. B. S. Schweigert (American Meat Inst. Foundation, Chicago and Univ. of Chicago). Intern. J. Appl. Radiation and Isotopes 6, 228(1959) Oct.

Economic considerations involved in commercial applications of irradiation by the food industry are reviewed. (C.H.)

1316

SAFETY IN THE OPERATION OF RADIATION SOURCES AND USE OF IRRADIATED FOODS. H. F. Kraybill (Army Medical Research and Nutrition Lab., Denver). Intern. J. Appl. Radiation and Isotopes 6, 233-54(1959) Oct.

The utilization of ionizing radiation for the preservation of foods represents an important advance in the field of food processing. Careful evaluation of the wholesomeness of irradiated foods has been made, and work is continuing; but, thus far, these foods have not been found to be toxic to experimental animals or man. In animal feeding experiments, with a broad spectrum of foods tested, longevity, reproduction, and lactation performance in general are the same as for animals maintained on diets of unirradiated food. Investigations conducted to the present time with mice and rats have not revealed any evidence as to radiation induced carcinogens. While some radiation damage to the macronutrients and micronutrients has been noted, the nutritive value for these foods is equivalent to, or in some cases better than, that for heat processed foods. Ionizing radiation has been shown to be quite effective in alteration of proteins, with the result that certain foods exhibit reduced allergenic properties. Of clinical significance, also, is the fact that low radiation doses of 14,000 rads effectively interrupt the reproductive cycle of the trichinae present in pork, and thereby eliminate the public health problem of trichinosis. Under present methods of processing, none of the irradiated foods has induced radioactivity. High energy radiation in the area of 24 Mev has been shown to produce transient and short lived radioactive isotopes. In the event that accelerated electrons with high energies are utilized in radiation treatment of food, the potential hazard of these radioactive isotopes, which are induced, will then be explored. An excellent safety program in the operation of radiation sources has been achieved. Radioactive contamination of food cans, by γ-irradiation with mixed fission products in the canal water, has been eliminated. Health physics procedures guarantee the safety of the product as to both contamination and induced radioactivity. Careful monitoring of personnel and equipment at the radiation source has resulted in an excellent record for safety. (auth)

1317

UNITED KINGDOM REGULATIONS COVERING SAFETY IN THE USE OF RADIATION SOURCES. S. Smith (H. M. Factory Inspectorate, London). Intern. J. Appl. Radiation and Isotopes 6, 269-73(1959) Oct.

Regulations concerning the use of radiation sources in the United Kingdom are reviewed. (C.H.)

1318

INDIVIDUAL COUNTRY STATEMENTS ON NATIONAL FOOD LEGISLATION AFFECTING THE USE OF IRRADIATED FOODS. Intern. J. Appl. Radiation and Isotopes 6, 274-8(1959) Oct.

Regulations are reviewed concerning the use of irradiated foods in France, Finland, the Federal Republic of Germany, Ireland, The Netherlands, Poland, Sweden, Switzerland, and the U.S.A. (C.H.)

1319

INDIVIDUAL COUNTRY STATEMENTS ON PROGRAMMES AND PLANS FOR RESEARCH ON THE USE OF IONIZING RADIATIONS FOR FOOD PRESERVATION. Intern. J. Appl. Radiation and Isotopes 6, 279-91(1959) Oct.

Programs and plans for research on the use of ionizing radiations for food preservation are summarized for Belgium, France, Italy, Poland, Sweden, the United Kingdom, and the U.S.A. (C.H.)

1320

RADIOISOTOPIC CONTAMINATION OF THE BIOSPHERE. U. Croatto (Universita, Padua). Minerva Nucleare 3, 269-78(1959) Sept. (In Italian).

The various natural and artificial sources of ionizing radiations are first considered in regard to the biological injuries for which they are responsible. The various sources of ionizing radiations of natural or artificial isotopic origin are then discussed from a critical quantitative standpoint. Radioisotopic contamination and the somatic and genetic consequences of experimental nuclear explosions are finally considered in detail. (auth)

1321

MEASUREMENT OF THE AMBIENT RADIOACTIVITY (MARCH 1957 TO DECEMBER 1958). PART I. L. Argiero, S. Nanfredini, and G. Palmas (Comitato Nazionale per le Ricerche Nucleari, Leghorn). Minerva Nucleare 3, 278-91 (1959) Sept. (In Italian).

The results of measurements of the atmospheric radioactivity made from March 1957 to December 1958 in central Italy are reported. In the first part of the article only the values referring to the air are presented. The natural activity and the artificial activity obtained from alpha and beta emitters were determined. (J.S.R.)

1322

SPECTROSCOPIC IDENTIFICATION OF ALPHA-EMITTING NUCLIDES IN BIOLOGICAL MATERIAL. W. V. Mayneord (Royal Cancer Hospital, London). Nature 184, 667-9(1959) Aug. 29.

A device for use in spectral analysis of the alpha-activity of normal biological materials is described. The sample is surrounded, in a gridless chamber, by a material with a very low alpha emission rate. In this way the background counting-rate corresponding to alpha-particle energies may be made very small. Preparation of sources and experimental results are discussed. The method is thought to have a high potential value in studies of radioactivity in biological materials. (J.R.D.)

1323

CULTURE OF ALGAE AND OTHER MICRO-ORGANISMS IN DEUTERIUM OXIDE. Henry L. Crespi, Sylvia M. Archer, and Joseph J. Katz (Argonne National Lab., Lemont, Ill.). Nature 184, Suppl. No. 10, 729-30(1959) Aug. 29.

Three species of green algae were successfully adapted to growth in 99.6% deuterium oxide. Escherichia coli, yeast, and paramecium were also grown in deuterium oxide. Procedures are described. Fully deuterated glucose, chlorophylls, and carotenoids were isolated from the deuterated algae. (C.H.)

1324

CHLOROPLAST PIGMENTS OF DEUTERATED GREEN ALGAE. Harold H. Strain, Henry L. Crespi, and Joseph J. Katz (Argonne National Lab., Lemont, Ill.). Nature 184, Suppl. No. 10, 730-1(1959) Aug. 29.

No new bands were found in chromatograms of chloroplasts from deuterated algae, and none of the usual bands were absent. The infrared spectra of pigments obtained from deuterated algae show essentially all the hydrogen positions occupied by deuterium. The deuterated pigments were determined to be effective in photosynthesis. (C.H.)

1325

DISTRIBUTION OF RADIOACTIVE BARIUM IN EYE TISSUES. R. J. Garner (Agricultural Research Council Field Station, Compton, Berks, Eng.). Nature 184, Suppl. No. 10, 733-4(1959) Aug. 29.

Observations on barium-140 demonstrate that barium is markedly concentrated in the uveal tract in the eye of herbivores. Data are tabulated on the distribution of barium in the eyes of rabbits and cows. (C.H.)

1326

BONE SODIUM AND Na^{22} EXCHANGE: RELATION TO WATER CONTENT. Gilbert B. Forbes (Univ. of Rochester, N. Y.). Proc. Soc. Exptl. Biol. Med. 102, 248-50(1959) Oct.

A study of marrow-free bone in a number of mammals reveals that sodium content is inversely related to water content. This relationship holds for a number of skeletal sites, and for dental structures. Studies of 2 species with aberrant serum sodium values suggests that bone sodium content also varies, in direct fashion, with serum sodium content. Radiosodium exchangeability of bone is also a function of bone water content. (auth)

1327

STUDY USING RADIOACTIVE CHROMIUM OF THE LIFE-TIME OF ERYTHROCYTES IN PATIENTS WITH ETHYLIC CIRRHOSIS AND ANEMIA. M. Peinard-Considère, A. Sarrazin, J. Canivet, and P. Fallot (Commissariat à l'Énergie Atomique, Paris). Pathol. et biol., Semaine hôp. [N.S.] 6, 551-7(1958) Apr. (In French)

The technique of labeling erythrocytes with radiochromium was applied to a group of eleven cirrhotic patients having anemia without significant hemorrhage. Eight of these patients were studied long enough to obtain usable results. All were found to have a reduction in the apparent life span of 50% of their red blood cells. It was shown that this phenomenon can be caused by two mechanisms: a reduction of the mean life span of the erythrocytes without increase of dispersion (acceleration of senescence) and a random destruction of the erythrocytes independent of aging. Experimental data do not exclude the possibility of a concomitant diminution in the release of new erythrocytes, but it gives evidence of an acceleration in the destruction of circulating red blood cells. (tr-auth)

1328

CONTINUED PROLIFERATION OF TRANSPLANTED RAT LYMPHOID CELLS IN IRRADIATED MICE. O. Brocades Zaalberg and D. W. van Bekkum (Medical Biological Lab., National Defence Research Council TNO, Rijswijk, Netherlands). Transplantation Bull. 6, 91-3(1959) Jan.

An investigation was made of the nature of lymphoid cells in radiation chimaeras resulting from transplantation of rat bone marrow to whole-body irradiated mice. The method of unstained cell counts was employed to identify mouse cells by the specific cytatoxic action of rat anti-mouse sera. Results indicate that a successful heterologous bone marrow transplantation is accompanied by a repopulation of the lymph glands with donor type cells. The identity of the lymphoid cells seemed to be closely linked to that of the other hematopoietic cells. (C.H.)

1329

AMELIORATION BY ADRENALECTOMY OF THE HOMOLOGOUS "WASTING DISEASE" INDUCED IN IRRADIATED HYBRID MICE BY INJECTION OF PARENTAL LYMPHOID CELLS. Henry S. Kaplan and Barbara H. Rosston (Stanford Univ. School of Medicine, San Francisco). Transplantation Bull. 6, 107-9(1959) Jan.

Prior adrenalectomy reduced the susceptibility of sublethally irradiated hybrid mice to the homologous wasting disease induced by injection with parental thymic cells. The mechanism of this protection was not established. In a small series of mice injected with spleen cells the microscopic manifestations of wasting disease seemed more severe in both the intact and adrenalectomized groups. Possible immunologic mechanisms involved in response to homologous cells are discussed. (C.H.)

1330

CUTANEOUS PAIN AND TISSUE DAMAGE PRODUCED BY THERMAL RADIATION. J. D. Hardy (Aviation Medical Acceleration Lab., Johnsville, Penna. and Univ. of Pennsylvania, Philadelphia). p.577-92 of "Proceedings of the First National Biophysics Conference." Henry Quastler and Harold J. Morowitz, eds. New Haven, Yale University Press, 1959. 815p.

A method of stimulating cutaneous pain and producing skin damage is described. When measured under controlled conditions, the pain threshold as determined by the thermal radiation method was observed to be uniform in subjects differing in sex, age, race, and cultural background. The thermal pain threshold is reached when the skin temperature has been raised to 45 ± 1.7°C. At this skin temperature, spinal reflexes in man and animals (nociception) are also elicited. It is pointed out that this temperature is also the threshold temperature for burning the skin. The close association of thermal pain and nociception to the rate of thermal inactivation of cutaneous cellular proteins is pointed out in terms of coincidence of threshold temperature, and the increase of pain intensity with skin temperature in proportion to the logarithm of the protein inactivation rate. An application of the theory relating nociception to the rate of tissue damage by heat is described in terms of inhibition of burn development by cold exposure. (auth)

1331
PROCEEDINGS OF A CONFERENCE ON RADIOBIOLOGY AT THE INTRA-CELLULAR LEVEL, HELD AT CATALINA ISLAND, SEPTEMBER 9-12, 1957. First U.C.L.A. Conference on Radiobiology. T. G. Hennessy, D. R. Howton, B. H. Levedahl, J. F. Mead, L. S. Myers, Jr., and O. A. Schjeide, eds. New York, Pergamon Press, 1959. 216p.

Factors affecting the radiosensitivity of cells, the sensitivity of different cells in the same organism, recovery mechanisms, and interactions between cells and tissues following exposure to ionizing radiations were discussed at this Conference. Suggestions were presented for future study. A complete subject index is included. (C.H.)

1332
DRITTE ARBEITSTAGUNG DER DRK-STRAHLENSCHUTZ-ÄRZTE. (Third Working Conference of DRK Radiologists). No. 9 of "Schriftenreihe des Bundesministers für Atomkernenergie und Wasserwirtschaft." Strahlenschutz. Brunswick, Gersbach and Sohn GmbH, 1959. 81p. DM 4.

The papers presented at the Third Conference of German Red Cross radiologists are given. The papers include: Standard Safety Instructions of the International Industrial Council for Workers in Radiation Industries; Drug Tolerances in Radiation Damage; Practice in the Practical Application of Mass Dosimetry; Practical Problems in Radiation Hematology; Measurement Techniques in the Area of Radiation Protection; Future Radiation Protection Laws in the Federal Republic; and Measurement Techniques for the Determination of Radioactivity in Air, Water, and Flora and Fauna. (J.S.R.)

Biochemistry, Nutrition, and Toxicology

1333 ARCRL-1
Great Brit. Agricultural Research Council. Radiobiological Lab., Grove, Berks, England.
STRONTIUM 90 IN HUMAN DIET IN THE UNITED KINGDOM. REPORT NO. 1. June 15, 1959. 85p. BIS.

Results are reported from a survey of strontium-90 content in the human diet in the United Kingdom during 1958. Data are tabulated on levels in the total diet, milk, cheese, potatoes, leafy vegetables, and flour. The content of stable strontium in the diet was measured. Factors affecting the uptake of strontium by humans are discussed. The movement of strontium-90 into food chains was traced. The relationship of the level of strontium-90 in the diet to world-wide fall-out levels is discussed. (C.H.)

1334 UR-424
Rochester, N. Y. Univ. Atomic Energy Project.
THE METABOLISM AND TOXICOLOGY OF STRONTIUM-90 IN THE RAT. RATIONALE, EXPERIMENTAL PROCEDURES, PILOT EXPERIMENTS. L. W. Tuttle, R. C. Baxter, M. Goldman, and W. F. Bale. Sept. 1, 1959. 28p. OTS.

In preparation for studies of the toxicity of strontium-90 in the rat, procedures have been established for the administration of Sr^{90} solutions by imbibition to rats under physiological conditions for periods of time, ranging from 10 days to 30 days. The conditions of exposure and dosages used were designed to simulate those under which human populations might be exposed as a result of nuclear accidents or acts of war. The body retention of Sr^{90} under laboratory conditions ranged from 1% of the administered dose in old rats to about 5% in very young rats. The metabolic removal of Sr^{90} from young adult rats, measured 40 days after dosing, was about 0.01% of the body burden per day. A simplified method for monitoring the body burdens of experimental animals in vivo by counting bremsstrahlung with a sodium iodide crystal is described. (auth)

1335
HISTOPATHOLOGIC EFFECTS OF RARE EARTHS ADMINISTERED INTRAPERITONEALLY TO RATS. A Preliminary Report. C. Harold Steffee (Oak Ridge Inst. of Nuclear Studies, Tenn.). A.M.A. Arch. Ind. Health 20, 414-19(1959) Nov.

Intraperitoneal administration of the stable rare earths, cerium, lanthanum, yttrium, praseodymium, neodymium, and a commercial mixture C-340 at relatively high dosage levels resulted in an acute peritoneal reaction, which subsequently developed into a true granulomatous peritonitis. Ascites frequently accompanied the acute inflammatory reaction. Intraperitoneal administration of these rare earths occasionally resulted in focal hepatic necrosis. Review of our autopsy material from human patients treated at a much lower dose level failed to reveal definite evidence of similar histologic effects. (auth)

1336
THE PHYSICO-CHEMICAL STATE OF PLUTONIUM (Pu^{239}) IN THE BLOOD UPON ITS INTRAVENOUS ADMINISTRATION. Yu. A. Belyaev. Med. Radiol. 4, No. 9, 45-51(1959) Sept. (In Russian)

The author studied the physico-chemical state of Pu^{239} in the blood upon its intravenous administration to rats in the form of nitrate of quadrivalent plutonium and a citrate complex. It was found that the speed of disappearance of plutonium from the blood is lesser for the complex salt than for plutonium nitrate. Up to 90 to 95% of plutonium circulating in the blood is bound with proteins. In the plasma the content of plutonium is 5 times higher than in the cellular elements. The electrodialysis of the serum of rats given plutonium divulged that in the blood approximately 10% of plutonium is in the form of negatively charged ions. Determination of the plutonium content in individual protein fractions, carried out by the method of paper electrophoresis, did not produce satisfactory results. The article discusses the data obtained. (tr-auth)

1337
EFFECTS OF A COMBINATION OF CYSTEINE AND ASCORBIC ACID ON THE CONTENTS OF PYRIDINE NUCLEOTIDES AND LACTODEHYDROGENASE IN RATS EXPOSED TO IRRADIATION. V. Mattai Del Moro (Università, Milan). Radiobiol. Latina 2, 95-8(1959) Jan.-Mar. (In Italian)

The effect of the protective substances cysteine plus ascorbic acid on the decrease of pyridine coenzymes and lactodehydrogenase in the liver of irradiated rats was studied. The combined administration of these compounds increases the pyridine coenzyme and lactodehydrogenase concentration only if it is given before irradiation. It has no effect if the cellular lesion is already produced. The relationship between the metabolism of pyridine coenzymes and cellular lesions in radiation sickness is discussed. (tr-auth)

Fallout and Radiation Ecology

1338 ARF-3127-9

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

PRELIMINARY STUDIES OF SCAVENGING SYSTEMS RELATED TO RADIOACTIVE FALLOUT. Letter report No. 9 [for] August 1 to October 1, 1959. J. Stockham and John Rosinski. Oct. 26, 1959. 6p. Contract AT(11-1)-626. OTS.

Air samples were taken with the Andersen sampler and the cyclone separator. The data are reported on the Sr^{90} and total beta activities of the samples. (W.L.H.)

1339 JEN-53

Spain. Junta de Energia Nuclear, Madrid.

RADIOACTIVIDAD ATMOSFÉRICA (MADRID). I. CARACTERIZACIÓN DE COMPONENTES DE VIDA CORTA. (Atmospheric Radioactivity (Madrid). I. Characterization of the Short-lived Components). F. de la Cruz Castillo, G. Dominguez Rodriguez, and R. Fernandez Cellini. 1957. 26p.

A detailed study was made of the atmospheric radioactivity of Madrid, its variation during the day, the determination of the short-lived components, and its behavior with respect to theoretical equations. A diurnal variation of the radioactivity was found with the maximum at 3 or 4 A.M., and the minimum occurred about 1 P.M. The activity accumulated on the filter agrees with a mathematical law derived from the assumption that there is an equilibrium in the atmosphere between radon and its daughters. Disequilibrium caused by the atmospheric instability provokes variations between the experimental and theoretical data. The short-lived components were identified as members of the RaB and ThB families. (J.S.R.)

1340 SCTM-206-55(51)

Sandia Corp., Albuquerque, N. Mex.

RADIATION BACKGROUND IN ALBUQUERQUE, NEW MEXICO, DURING AND AFTER THE TEAPOT SERIES. Howard H. Sander and Thomas B. Cook, Jr. Sept. 15, 1955. 12p. OTS.

Radiation background intensity has been monitored on a continuous, 24-hour basis since February 1, 1955. The increase in total dose received in Albuquerque due to the TEAPOT tests, over what the dose would have been had there been no tests, is 4.5 milliroentgens. Forty times this amount of radiation (180 mr) is received during a normal chest x ray. (auth)

1341 WASH-1024

Division of Biology and Medicine, AEC.

A REVIEW OF POTENTIAL RADIONUCLIDES PRODUCED IN WEAPONS DETONATIONS. Alfred W. Klement, Jr. July 30, 1959. 107p. OTS.

Estimates have been made of what the probable radionuclides produced in weapons detonations, including fission products and neutron-induced radionuclides in air, soils, and sea water will be. The nuclear and decay properties and some metabolic or biological properties of these nuclides are tabulated where available. Estimates are made of the amounts of the radionuclides produced in weapons detonations. Some radionuclides are discussed with respect to their particular biological interest from the standpoint of the hazard to man. (auth)

1342 CEA-tr-A-596

AÉROSOLS RADIOACTIFS DE LONGUE PÉRIODE DANS L'ATMOSPHÈRE. (Radioactive Aerosols of Long Life in the Atmosphere). Translated into French by M. L. Brini from ORION (Munich), Nos. 23/24, 20-2(1956). 9p.

Some remarks made at a conference on suspended particles by G. Schumann of Heidelberg and K. Bisa of Grafschaft/Hochsauerland on long-lived radioactive aerosols in the atmosphere are recorded. (T.R.H.)

1343

STRONTIUM-90 IN THE AUSTRALIAN ENVIRONMENT, 1957–58. F. J. Bryant (Atomic Energy Research Establishment, Harwell, Eng.) and L. J. Dwyer, J. H. Martin, and E. W. Titterton (Australian Atomic Weapons Tests Safety Committee). Nature 184, 755-60(1959) Sept. 12.

Within the sampling errors, and apart from some local variations noted, the levels of strontium-90 in the material examined are uniform throughout Australia. This indicates that the strontium-90 fall-out over the continent arises from high-yield fission weapon tests overseas; as expected the contribution from local weapon tests is too small to be detected. The rate of deposition of strontium-90 and its accumulation in Australian soils are one-fourth to one-third those in the more densely populated areas of the northern hemisphere. The levels of strontium-90 in Australian human bone tissue and milk lie between one-third and one-half those in the northern hemisphere. This level is a little higher than would be expected from the fall-out rate and the soil data, but the difference is not established statistically. If further experiments prove this difference to be real it would be hard to explain satisfactorily. The possible biological consequences to the population of Australia, of the fall-out levels reported in this paper, have been assessed by the Australian National Radiation Advisory Committee. The Committee concluded that the possible hazards are very small in comparison with those already accepted in technically advanced communities. (auth)

1344

BIOGEOCHEMICAL ENRICHMENT OF FISSION PRODUCTS. Pontus Ljunggren (Geological Inst., Lund, Sweden). Nature 184, Suppl. 12, 912(1959) Sept. 19.

In a radioactivity analysis of plants, the beta activity of the plants was found to be 2 to 6 times greater than the soil from which the plant came. The beta activity concentration in various parts of the plants is discussed. (C.J.G.)

1345

THE ABSORPTION OF RADIOACTIVE STRONTIUM BY PLANTS UNDER FIELD CONDITIONS IN THE UNITED KINGDOM. G. M. Milbourn, F. B. Ellis, and R. Scott Russell (Agricultural Research Council, Grove. Berks, Eng. and Agricultural Research Council, Field Station, Compton, Berks, Eng.). Reactor Sci. 10, 116-32(1959) Sept.

The absorption of radioactive strontium by crop plants was investigated in field experiments on six soils which represent a wide range of arable land in Britain. Sr^{89} was applied as a spray, and cultivation procedures were employed to place it at different depths below the soil surface. Three test crops were grown in each experiment. In a grass-clover pasture mixture ploughed to the depth of 12 in. the absorption of Sr^{89} and the ratio of Sr^{89} to Ca in plants was found to be on the average less than 30% of that observed when the Sr^{89} was left on the surface. Only small effects of placement occurred with deeper rooted species. When established pasture was contaminated the level of Sr^{89} in the tissues formed subsequently was up to 5 times higher than in grass sown on contaminated ground. The effects of the Ca status of the soil and of added lime were examined. The Sr^{89} content of plants and the ratio of Sr^{89} to Ca were highest when the soil was low in Ca (2 milliequivalents Ca per 100 g extracted with N ammonium acetate). Relatively small differences occurred when the soils contained more than 7 milli-equivalents of Ca. The effect of added lime was variable and differences between experiments cannot be attributed entirely to differences in soil calcium. (auth)

1346

ZINC-65 IN FOODS. G. K. Murthy, A. S. Goldin, and J. E. Campbell (Robert A. Taft Sanitary Engineering Center, Cincinnati). Science 130, 1255-6(1959) Nov.

Small quantities of Zn^{65} have been found in a wide variety of foods obtained from the local markets serving Cincinnati, Ohio. The highest levels of radioactivity were observed in oysters harvested from Chesapeake Bay; however, none of the samples contained significant quantities of this radionuclide in terms of a potential radiological health hazard. In view of the widespread occurrence of Zn^{65} in foods, it has been postulated that this radionuclide has been dispersed by high-altitude fall-out. (auth)

1347

RADIOACTIVE FALLOUT DATA. Collected from Eleven Atomic Energy Commission Installations, for 1958. Gordon M. Dunning, ed. Washington, D. C., U. S. Atomic Energy Commission, 1959. 110p. $0.65(GPO).

Air sampling data are summarized which were collected during 1958 at eleven installations associated with the United States Atomic Energy Commission. (C.H.)

Radiation Effects on Living Tissues

1348 AECU-4405

Massachusetts. General Hospital. Mixter Labs. for Electron Microscopy, Boston.

STUDIES OF THE EFFECTS OF IONIZING RADIATION ON THE ULTRASTRUCTURE OF DEVELOPING NERVOUS TISSUE AS REVEALED BY ELECTRON MICROSCOPY. Annual Report [for] November 1, 1958 to October 31, 1959. Humberto Fernández-Morán. 36p. Contract AT(30-1)-2278. OTS.

Progress is reported in the development of improved low-temperature preparation techniques and instrumentation for electron microscopy of cells and model systems. A new type of multiple objective aperture for high resolution electron microscopy and several technical developments in the field of low-temperature electron microscopy are described. Improved specimen preparation methods were developed based on ultrarapid freezing followed by freeze-substitution and embedding in polymers at approximately −130°C. Preliminary attempts were made to develop high-resolution autoradiography techniques for electron microscopy. Results are described from applications of the cryofixation techniques and electron microscopy in examinations of photoreceptors, nerve myelin sheaths, cell nuclei, granules of the retinal pigment epithelium, embryonic cells, and tumor cells. The use of radioactive tracers in connection with low-temperature preparation techniques is reported to be particularly promising. Abstracts are included of papers which were published or communicated at scientific meetings. (C.H.)

1349 AECU-4409

Marquette Univ., Milwaukee. School of Medicine.

STUDY OF LONG-TERM PATHOLOGIC EFFECTS OF RADIOACTIVE ISOTOPES OF CALCIUM AND STRONTIUM IN BONE AND SOFT TISSUES, ESPECIALLY WITH REFERENCE TO BONE TUMOR PRODUCTION. Final Technical Report for May 16, 1958—August 31, 1959. Joseph F. Kuzma, and Gloria E. Zander-Principati. 63p. Contract AT(11-1)-105. OTS.

Findings are summarized from a nine-year study on the pathologic effects of radioactive strontium and calcium in bone and soft tissues of mice, rats, and dogs. Data are included on the incidence of bone tumors following injection of strontium-89 and calcium-45, the effectiveness of zirconium citrate and other chemicals in prolonging the latent period of strontium-89 induced bone cancer; the effects of surgical removal of strontium-89 burdened bone spongiosa on incidence of bone tumors; the effect of cold environment on the development of bone tumors following injection of cancerogenic dose of strontium-89; the long-term pathologic effects of strontium-89 -90 in pregnant mice, their offspring, and later generations; the effect of chronic lead intoxication on bone cancer production by radioactive calcium or strontium; the effect of beta-aminopropionitrile fumarate on strontium-89 production of bone tumors; the effect of a low phosphorus diet on the production of bone tumors by strontium-89; the development of squamous cell carcinoma at the site of injection of strontium-89; and the retention of cancerogenic doses of strontium-89 -90 by various parts of the skeleton. Counting techniques are described. (C.H.)

1350 AECU-4432

Chicago Medical School.

FINAL REPORT, ATOMIC ENERGY COMMISSION CONTRACT AT(11-1)-194. [1959]. 5p. OTS.

Preliminary results are summarized from a study on the carcinogenic effects of beta radiation on skin. Emphasis was placed on the development of latent tumors following low-level exposure. The skin of mice was locally irradiated with 800 rep beta from plaques of thallium-204. This dose did not induce skin tumors. These mice were treated with croton oil, a tumor-producing agent, and tumors were induced. Control animals treated with the same amounts of radiation or croton oil did not develop tumors. Quantitative dose response phenomena were studied. Data are included from studies on thermal burns with and without croton oil treatment, and the response of beta-irradiated skin to various dosages of carcinogenic hydrocarbons. (C.H.)

1351 CTR-357

Office of Technical Services, Washington, D. C.

FOOD PRESERVATION BY IRRADIATION, 1951—58. Catalog of Technical Reports. 4p. OTS.

A bibliography containing 73 references on aspects of food irradiation published from 1951 to 1958 is presented. A brief description of the contents of each item is given along with the price. (J.R.D.)

1352 NYO-2861

Massachusetts Inst. of Tech., Cambridge.

RADIOSENSITIVITY OF VARIOUS SPECIES OF BACTERIA UNDER DIFFERENT ENVIRONMENTAL CONDITIONS. Final Report for the Period December 15, 1958 to August 31, 1959. B. E. Proctor, S. A. Goldblith, G. J. Fuld, and G. Silverman. 22p. Contract AT(30-1)-1719. OTS.

The radiosensitivity of spores, germinated spores, and subsequent out-growth of Bacillus subtilis, morphotype globigii, were determined in various media. In order to obtain these morphological states, studies were conducted to determine the environmental conditions necessary to achieve these forms. In general, 98 to 99% germination was obtained in 30 minutes. The mean lethal dose, D_0, of spores of Bacillus globigii is 71,000 rep in the presence of air. Spores germinated in phosphate buffer, yeast extract broth, tryptone-glucose-beef extract broth, nutrient broth, and Halvorson broth possessed D_0's in the range of 6800 to 7700 rep if irradiated in the presence of air. Irradiation of these spores in nutrient broth and Halvorson's broth, but in the presence of a nitrogen atmosphere, increased the D_0 to 17,600 rep. When germination was allowed to proceed to the stage in which vegetative forms were obtained, radiosensitivity, determined in the presence of air, was found to increase to a value of 12,000 rep. A procedure for obtaining spores from germinated cells within two hours was developed. These spores do not appear to be heat-resistant. (auth)

1353 JPRS-1343-N

THE INFLUENCE OF IONIZING RADIATION ON THE UPPER BRANCHES OF THE CENTRAL NERVOUS SYSTEM (CONFERENCE AT THE INSTITUTE OF HIGHER NERVOUS ACTIVITY). I. A. Piontkovskii (Piontkovskiy). Translated from Vestnik Akad. Nauk S.S.S.R. 28, No. 8, 125-6(1958). 4p. OTS.

The effects of ionizing radiation on the upper branches of the central nervous system were discussed at a conference. Twenty-six papers were presented. The reports were centered about two aspects; the condition of the higher nervous activity of adult animals following irradiation at various periods in parental life, and the effects of small doses of ionizing radiation on the higher nervous activity of animals. (J.R.D.)

1354 JPRS-1408-N

CHARACTERISTICS OF THE CLINICAL COURSE OF BURN SHOCK UPON IRRADIATION OF THE ORGANISM WITH PENETRATING RADIATIONS. G. A. Zubovskii (Zubovskiy). Translated from Vestnik Rentgenol. i Radiol. 33, No. 2, 84-6(1958). 4p. OTS.

The clinical course of burn shock which developed in rabbits during the initial phases of radiation sickness was investigated. Radiation sickness was induced by total-body x irradiation at a dose of 700 γ with a dose strength of 27 γ/min. Observations on animal behavior, pupil light reflex, corneal reflex, muscle tone, and hematologic changes were recorded. (J.R.D.)

1355 JPRS-1413-N

ON THE FORMATION OF TOXIC AGENTS DURING RADIATION STERILIZATION. M. N. Shal'nova. Translated from Zhur. Obshcheĭ Biol. 19, 234-8(1958). 7p. OTS.

Studies showed that in irradiated yeasts grown for a time after irradiation, biologically active and toxic substances are formed which noticeably influence the respiratory processes of the indicator yeast cultures, and the activity and viability of amoebae fed with irradiated yeasts. Implications of the findings on the wholesomeness of irradiated foods are discussed briefly. (C.H.)

1356 JPRS-L-690-N

THE EFFECT OF GENERAL IRRADIATION BY X-RAYS ON THE RESTORATION OF SERUM PROTEINS IN DOGS AFTER HEMORRHAGE. V. M. Rodionov, V. D. Uspenskaya, O. G. Zamyatkina, T. Grunt, and V. P. Polyakov. Translated from Voprosy Med. Khim. 4, 327-38(1958). 19p. OTS.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 20860.

1357 JPRS-L-713-N

THE EFFECT OF A SINGLE IRRADIATION WITH X-RAYS ON THE DEVELOPING RAT BRAIN. Ye. N. Kosmarskaya and Yu. I. Barashnev. Translated from Med. Radiol. 3, No. 2, 23-31(1958). 14p. OTS.

This paper was previously abstracted from the original language and appears in NSA, Volume 12, as abstract No. 9599.

1358 JPRS-L-714-N

THE CHANGE IN THE LATENT PERIOD OF THE FLEXOR REFLEX OF THE SHIN IN RABBITS FOLLOWING GENERAL IRRADIATION WITH A 10 R DOSE OF X-RAYS. I. V. Fedorova. Translated from Med. Radiol. 3, No. 2, 32-6(1958). 9p. OTS.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 9600.

1359 JPRS-L-765-N

EFFECT OF B-COMPLEX VITAMINS ON THE RESISTANCE OF THE ORGANISM TO RADIATION ACTION. A. N. Liberman. Translated from Fiziol. Zhur. Akad. Nauk Ukr. R.S.R. 4, 814-20(1958). 10p. OTS.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 20819.

1360 JPRS(NY)-L-437

ON THE PROBLEM CONCERNING THE FUNCTIONAL CONDITION OF THE LIVER IN PEOPLE HAVING CONTACT WITH RADIOACTIVE SUBSTANCES. Ye. A. Denisova. Translated from Med. Radiol. 2, No. 6, 44-9 (1957). (PB-141336-T). OTS.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 5169.

1361 NP-tr-299

LEUKEMOGENESIS IN AkR MICE IRRADIATED (X-RAY) AT BIRTH. (Leucémogenèse Chez Des Souris AKR Irradiées (rayons X) à la Naissance). J. Reverdy, G. Rudali, J.-F. Duplan, and R. Latarjet. Translated by P. Hajdu (National Institutes of Health, Bethesda, Md.) from Sang, Le 29, 796-804(1958). 17p.

AkR mice, which have a high incidence of spontaneous lymphoid leukemia, were exposed at birth to single whole-body doses of x radiation ranging from 50 to 500r. X irradiation lowered the frequency of leukemia. The average latency remained unchanged. The involution of the thymus produced by irradiation did not appear to cause the results. Possible factors affecting leukemogenesis are discussed. (C.H.)

1362 NP-tr-300

FREQUENCY OF LEUKEMIA AND TUMORS IN $C_{57}Bl_6$ MICE HAVING RECEIVED PLASMA FROM IRRADIATED ANIMALS AT BIRTH. (Fréquence de Leucémies et de Tumeurs chez des Souris $C_{57}Bl_6$ Ayant Recu à la Naissance du Plasma d'animaux (Irradiès). Geörges Mathé and Jean Bernard. Translated by P. Hajdu (National Institutes of Health, Bethesda, Md.) from Rev. franç. études clin. et biol. 3, 257-8(1958). 7p.

Seventy-four $C_{57}Bl_6$ mice were injected soon after birth with plasma from adult animals of the same strain previously subjected to irradiation. Out of 11 animals surviving the injection four died of leukemia, one of reticulum cell sarcoma, and four of epithelial tumors. This incidence of leukemia and tumors is considerably higher than in the control animals. (auth)

1363 SCL-T-277

X-RAY AND MARROW-BONE CELL TREATMENT OF AK MICE AFFECTED BY SPONTANEOUS AND VERY ADVANCED LEUKEMIA. (RÉSUMÉ). (Essai de Traitement, par l'irradiation X Suivie de l'administration de Cellules Myéloides Homologues, de Souris AK Atteintes de Leucémie Spontanée Très Avancee). G. Mathé and Jean Bernard. Translated by Marcel I. Weinreich (Sandia Corp.) from Bull. cancer 45, 289-300(1958). Résumé Only, pp.299-300. JCL.

Results are summarized from a study of the response of mice affected by spontaneous leukemia to treatment with injections of bone marrow cells after irradiation with doses in the $LD_{100/30}$ range. In the more favorable cases, in which survival exceeded 30 days, death was due either to leukemia or to homologous disease. The results observed are discussed. (C.H.)

1364

RADIATION CHANGES IN CARCINOMA OF THE CERVIX AS REVEALED BY CYTOLOGY AND THEIR ROLE IN DETERMINING PROGNOSIS. E. Day (Memorial Center for Cancer and Allied Diseases, New York). Acta Union Intern. contra le Cancrum 14, 355-7(1958).

The utilization of radiation changes in cytologic smears for prognostic purposes concerning the radiosensitivity or radioresistance of malignant tumors of the uterine cervix has been quite successful. Critical investigation of the method showed accordance with certain aspects, but did not produce full agreement on all points. Reservations of cytologic, clinical-anatomical and statistical nature came up, which concern the method and its application. They are discussed in detail with the intent of eliminating sources of errors and misconceptions and to stimulate more research for possible improvement of the method. (auth)

1365

SUBACUTE AND LATE CARDIOVASCULAR SEQUELAE TO LOW DOSES OF GAMMA RADIATION. Durwood J. Smith, Robert C. Parker, Calvin Hanna, and Henry E. Curley (Univ. of Vermont, Burlington). Am. J. Physiol. 197, 725-9(1959) Oct.

A battery of in vivo and in vitro tests of cardiovascular performance were used to assess the effects of whole-body gamma radiation (cobalt-60) upon the cardiovascular system of dogs. A new method for study of the pressure-volume relations of isolated surviving arteries is described. Groups of six beagles were exposed to 30 r and 100 r 22 months before death and compared with littermate controls. No differences between irradiated and control dogs could be demonstrated. Eight mongrel dogs received 300 r 30 days before death and were compared with five mongrel controls. The only significant difference observed was in the pressure-volume curves of arteries from irradiated dogs, these vessels having a greater initial tone than control arteries. It is concluded that 30 r and 100 r of whole-body gamma radiation have no demonstrable effect upon the cardiovascular system of dogs irradiated 22 months before study, but that 300 r of gamma radiation does produce a significant abnormality of blood vessels. (auth)

1366

DEUTERON IRRADIATION OF THE MONKEY PITUITARY. M. E. Simpson, G. Van Wagenen, D. C. Van Dyke, A. A. Koneff, and C. A. Tobias (Univ. of California, Berkeley and Yale Medical School, New Haven). Endocrinology 65, 831-57(1959) Nov.

Observations on the effects of pituitary irradiation in monkeys are reported. An effort was made to determine whether irradiation exerts a selective effect on the functions of different cell types in the pituitary, and to determine the dosage necessary for complete destruction of the pituitary. It was possible to irradiate the monkey pituitary with single doses of 4,500 and 9,000 rep deuterons with a remarkable localization of the lesion to the pituitary. Long term observations on the monkeys are reported. (C.H.)

1367

EFFECT OF CELL DIVISION INHIBITION ON THE PHOSPHORUS METABOLISM OF GROWING CULTURES OF SACCHAROMYCES CEREVISIAE. Bernard J. Katchman, William O. Fetty, and Kenneth A. Busch (Mound Lab., Miamisburg, Ohio). J. Bacteriol. 77, 331-8(1959) Mar.

The effect of cell division inhibition on the phosphorus metabolism of growing yeast cultures is described. Although cell division inhibition was produced by such diverse inhibitors as alpha and x irradiation, nitrogen mustard, and triethylene melamine, a uniform pattern in the phosphorus spectrum is evidenced which may be associated specifically with cell division inhibition. Orthophosphate, insoluble polyphosphate, and deoxyribonucleic acid phosphorus fractions decrease as the residual labile-phosphorus fraction increases, whereas ribonucleic acid phosphorus and lipid-phosphorus fractions show no changes. Where changes were observed in the stable-phosphorus and pH 2.5 acid-soluble polyphosphate fractions, these were considered to be nonspecific and not likely to be associated with cell division. The metabolic aberrations brought about by cell division inhibition appear to be related to interference in insoluble polyphosphate and deoxyribonucleic acid synthesis. Maintenance of growth is reflected in these cultures by their ability to sustain normal metabolic intracellular concentrations of ribonucleic acid and lipid. The possible role of the insoluble polyphosphates in cell division is discussed. (auth)

1368

THE SENSITIVITY OF THE NERVOUS SYSTEM TO LOW RADIATION DOSES. M. N. Livanov and I. N. Kondratieva. Med. Radiol. 4, No. 9, 3-13(1959) Sept. (In Russian)

Data are presented on the sensitivity of the nervous system to radiation. It is shown that the action of ionizing radiation on the nervous system, even in very low doses, could accumulate and, thus, create long-term alternative processes. On the basis of the facts the authors presume that the limits of sensitivity of the nervous system to radiation and the extent of its alternative action, as a result of reparation processes, may not coincide. (tr-auth)

1369

CHANGES OF CONDITIONED REFLEX ACTIVITY IN THE OFFSPRING OF DOGS WHO HAD SUSTAINED THE CHRONIC ACTION OF Sr^{90}. V. A. Nazarov. Med. Radiol. 4, No. 9, 13-17(1959) Sept. (In Russian)

An investigation was made of the conditioned reflex activity in the adult offspring of dogs who had sustained chronic intravenous β-irradiation, as a result of daily administration of Sr^{90} with food (0.2 to 0.02 mc/kg) for a period of 17 to 28 months. This action, as assessed by the changes of defense conditioned reflexes, leads to a biological inferiority of the offspring as indicated by a decrease of the force and mobility of nervous processes and disturbance of their reciprocal steadiness. The progeny of chronically irradiated dogs have a very pronounced affinity for the inhibitory process. A relatively rapid evolvement of defense conditioned reflexes, difficulty of their extinction, a reduced capacity for precise differentiation, and a susceptibility to nervous activity disruption are common characteristics. The disorders of the reactivity of the great hemispheres of the brain are one of the earliest indices of remote sequelae of irradiation. (tr-auth)

1370

CHANGES OF CERTAIN ELECTROCARDIOGRAM INDICES IN ACUTE RADIATION SICKNESS INDUCED BY β-RADIATION AND X-RAY IRRADIATION. I. N. Bukhalovskii. Med. Radiol. 4, No. 9, 24-9(1959) Sept. (In Russian)

Changes of the electrocardiogram in radiation sickness have been described by a number of authors. However, they are almost exclusively related with gamma- and x-ray affections. The majority of investigators are of the opinion that the electrocardiogram in radiation sickness changes only in cases of severe affection, as a result of which inadequate attention is paid to this method of investigation in the management of radiation sickness patients. Data are presented which show that this opinion is erroneous. These data concern the relatively unknown problem of the disturbances of the myocardial function in radiation injuries from isotopes. Although the latter are generally analogous with other radiation affections, they are characterized by a number of specific features. (tr-auth)

1371

THE CHANGE OF PULMONARY BLOOD VESSELS IN EXPERIMENTAL RADIATION SICKNESS. I. S. Amosov. Med. Radiol. 4, No. 9, 33-8(1959) Sept. (In Russian)

Using the method of angiocardiography the author studied the specific features of pulmonary circulation in 67 rabbits in physiological conditions and in radiation sickness of the 2nd and 3rd degree, induced by a single total x irradiation (1000 r). During the period of primary radiation reaction, after the initial dilatation, the tone of all pulmonary vessels considerably increases, the blood flow slows down, there appear areas of decelerated blood circulation (hypotasis), and the Bainbridge reflex disappears. As the result of the above, conditions are created for retrograde movement of the contrast substance along the inferior vena cava into the dilated vessels of organs of the abdominal cavity. In the latent period there is noted a relative normalization of blood circulation, however, the signs of dystonia of pulmonary vessels are preserved. At the peak of the affection there is seen in the majority of experimental animals stenosis of arteries, veins, and all minute vessels of the lungs, a deceleration of blood flow, and repeated disappearance of the Bainbridge reflex. Due to dystonia of vessels there occur vast areas of retarded circulation (hypostasis) of segmentary or lobar nature. During the period of recovery dystonia of small pulmonary vessels was preserved for a prolonged time and the pulmonary circulation was more accelerated as compared with normal conditions. The author concludes that functional and anatomical changes of pulmonary vessels are only a manifestation of the general disturbance of hemodynamics in the irradiated organism. Their occurrence is connected first of all with the disturbance of mechanisms of reflex regulation of blood circulation. (tr-auth)

1372

ELECTRONOMICROSCOPIC INVESTIGATION OF TISSUE HOMOGENATES OF ANIMALS IN EXTERNAL AND INTERNAL IRRADIATION. A. I. Polivoda and A. A. Zolotova. Med. Radiol. 4, No. 9, 39-45(1959) Sept. (In Russian)

The author studied the electron—microscopic picture of the light fraction of centrifuged liver and spleen homogenates of control and irradiated rats and mice. The external irradiation was conducted with Co^{60} gamma-rays (800 r), and internal Po^{210} alpha rays (0.2 mc/kg). Upon irradiation there appear in the tissue homogenates thread-like formations of lipoid nature. (tr-auth)

1373

CHANGES OF NUCLEOPROTEIN EXCHANGE IN THE LIVER AND KIDNEYS OF RATS IN COMBINED AFFECTION OF THE ORGANISM (X-RAY IRRADIATION AND THERMAL BURN). P. D. Demidova. Med. Radiol. 4, No. 9, 52-6(1959) Sept. (In Russian)

The author studied the inclusion of P^{32} into nucleic acids, which were firmly bound with protein, in the liver and kidneys of rats immediately after thermal burn, x irradiation (1,000 r), and combined injury (thermal burn and whole-body x irradiation). The inclusion of phosphorus into nucleic acids of the liver (RNA and labile DNA) and kidneys (RNA and stable DNA) following a burn in some animals intensifies, while in others the inclusion becomes inhibited. After irradiation the inclusion of phosphorus into all fractions of nucleic acids of the liver and kidneys becomes inhibited, except RNA of the liver, in which P^{32} inclusion intensifies. In combined injury the inclusion of phosphorus in the labile DNA of the liver and kidneys is inhibited to a greater degree as compared with that in only burn or irradiation injury. The concentration of phosphorus in nucleic acids of the liver and kidneys after all types of affection is almost unchanged. (tr-auth)

1374

THE ACTION OF Po^{210} ON THE ORGANISM. B. B. Moroz and N. P. Smirnova. Med. Radiol. 4, No. 9, 66-74(1959) Sept. (In Russian)

A review is presented of the pathological effects of Po^{210} on tissue and mucous membrane of various animals. An analysis is made of the clinical picture and biological effects following exposure to Po^{210} by various methods. Disturbances of regulating mechanisms, changes in blood circulation, thermal regulations, and carbon exchange are discussed. (R.V.J.)

1375

THE INFLUENCE OF TOTAL X-RAY IRRADIATION ON THE EXCRETION WITH URINE OF SUBSTANCES DETERMINED BY DISHE REACTION (PRELIMINARY REPORT). N. A. Fedorov (Central Inst. of Post-Graduate Studies in Medicine, Ministry of Health, USSR). Med. Radiol. 4, No. 9, 75-6(1959) Sept. (In Russian)

Four series of experiments were carried out with 200 g. white rats in order to confirm the data presented by Ts. V. Dishe (Nucleonic acids, Moscow, 1957) on total x irradiation effects on the excretion of substances in the urine. The preliminary data confirmed the previously obtained results, moreover, it was also found that in addition to the excretion of substances containing desoxyribose, the irradiation induces an increase of other substances which produce rose coloration with 75% sulfuric acid. (R.V.J.)

1376

DISTURBANCE AND RESTORATION OF THE SECRETORY FUNCTION OF THE GASTROINTESTINAL TRACT IN RADIATION SICKNESS. M. E. Nesterin. Med. Radiol. 4, No. 9, 76-7(1959) Sept. (In Russian)

Radioinduced disturbances and restoration in the secretory function of the stomach and gastrointestinal tract were compared. It was confirmed that changes in the gastrointestinal tract are more pronounced than in the stomach; blood appeared in the gastric juices but did not show up in stomach juices; at various periods the level of fermentation elements was lowered in the gastric juices while pepsin secretion did not change. The restoration time of disturbed secretion at various sections in the gastrointestinal tract increased as the bond with the central nervous system weakened. (R.V.J.)

1377

STUDY BY MEANS OF RADIOACTIVE IRON OF THE LIFE CYCLE OF THE ERYTHROCYTES IN IRRADIATED ANIMALS. B. Bellion and L. Resegotti (Università, Turin). Minerva Nucleare 3, 241-4(1959) July-Aug. (In Italian).

A comparative study was made in normal adult rabbits on the effect induced on erythropoiesis by 200 kv x-rays therapy and 31 Mev betatron. The rate of disappearance of radioiron from plasma and the uptake in circulating RBC was followed after intravenous injection of Fe^{59} in vitro. At the same dose level erythropoiesis was damaged more by 200 kv therapy; the entity of the damage showed a large field of individual variation. The importance of free radicals generated by irradiation of plasma with high dose rates was shown by the marked inhibition of erythropoiesis induced in animals injected intravenously with plasma previously exposed to high radiation doses. (auth)

1378

EFFECT OF WHOLE-BODY GAMMA IRRADIATION ON I^{131} UPTAKE IN THE THYROID OF THE RAT. V. Bocci (Università, Siena, Italy). Minerva Nucleare 3, 253-6(1959) July-Aug. (In Italian)

I^{131} injections were used to determine the changes in the functional activity of the thyroid caused by whole-body gamma radiation. Four groups of Wistar rats were exposed to gamma radiation and on the first, third, and seventh day after exposure were injected with 30 μc of I^{131}. The radioiodine uptake was determined 1, 4, 7, and 12 hr after injection. Compared with the controls, the iodine uptake by the thyroid of the irradiated animal increased 8.2% on the first day, but on the seventh it decreased 45.4%. These results are statistically significant. The results of the investigation are discussed, and it is concluded that this dosage facilitates the determination of the thyroid malfunction caused by whole-body irradiation. (auth)

1379

METABOLIC CHANGES INDUCED IN MAMMALIAN ERYTHROCYTES BY WHOLE-BODY X-IRRADIATION. D. A. Rappoport and B. W. Sewell (Baylor Univ., Houston, Tex.). Nature 184, 846-9(1959) Sept. 19.

Since mammalian erythrocytes are enucleated no resyntheses of proteins can occur and any radiation damage incurred on the enzyme—proteins, such as denaturation or rupture of peptide linkage, should be detectable by changes in enzymic reactions. An investigation was made of erythrocyte enzyme systems as an indication of radiation damage. Results are presented graphically. It is tentatively concluded that the erythrocyte is a promising tissue component as an internal mammalian x-ray indicator. (C.H.)

1380

INDUCED MUTATIONS OF X-RAY IRRADIATIONS IN CULEX FATIGANS WIED (1828). R. Pal and B. S. Krishnamurthy (Malaria Inst. of India, Delhi). Nature 184, Suppl. No. 9, 658(1959) Aug. 22.

Mutations were induced in Culex fatigans by exposure to x radiation. Four morphological aberrations were observed in the first generation following exposure of normal laboratory-bred pupae. Mosquitoes with only one of the mutations were bred successfully. Details of the F_2 generation are tabulated. (C.H.)

1381

EFFECTS OF IRRADIATION OF NERVE ON MUSCULAR RESPONSE. A. Portela, D. Brandes, G. H. Bourne, Marion Hines, P. Stewart, and B. L. Redd, Jr. (Emory Univ., Atlanta). Nature 184, Suppl. No. 10, 734-5(1959) Aug. 29.

The effects of gamma and x radiation on the excitability and conductivity of the sciatic nerve of the frog were studied for doses up to 80,000 r and an attempt made to correlate results with muscular response. Either the whole nerve or a short segment was irradiated. Excitability and conduction velocity of the nerve and the response of the attached gastrocnemius muscle were recorded both during and after irradiation. Observations were also made of the mechanical activity of the nerves. No stimulation of the nerves by irradiation was observed, but complex and paradoxical effects on the excitability of non-irradiated segments were found. Data are presented graphically and experimental procedures and results are described. (C.H.)

1382

LATENT PERIOD OF X-RAY INDUCED AGEING: A STUDY BASED ON MORTALITY RATE AND TUMOUR INCIDENCE. H. I. Kohn and P. H. Guttman (Univ. of California, San Francisco). Nature 184, Suppl. No. 10, 735-6(1959) Aug. 29.

The increase in age-specific chronic mortality rate that occurs after a single whole-body exposure to ionizing radiation has been used as a parameter of aging. Results are presented from a study using mice to determine whether or not the increase occurs immediately or only after a latent period. The mortality rate was calculated at various intervals following irradiation. Data on life shortening and tumor incidence are summarized. Results indicate that older animals may suffer less life shortening following irradiation than younger ones of the same strain. (C.H.)

1383

TWO CASES OF OCCUPATIONAL CATARACT OF THE EYES CAUSED BY SMALL DOSES OF X-RAY IRRADIATION. J. Jindřichová (Krajský ústav národního zdraví, oddělení pro prevenci léčení a posuzování chorôb z povolání, Hradec Králové, Czech.). Pracovní lékařství 11, 254-6(1959). (In Czech.)

A bilateral case of cataract in a doctor who had been exposed to small doses of x rays for 22 years. The x-ray cataract was typical, i.e., it developed on the posterior part of the capsule of the lens where there were numerous vacuoles developed in the subcapsular portion of the cortex. Another case of x-ray cataract in an industrial woman worker after six-months alternating exposure to one-hour doses of 0.025 to 0.5 r is described. The damage manifested itself three years after the worker had left the x-ray work area. (auth)

1384

FRESH, DISINTEGRATED PLATELETS IN RADIATION THROMBOCYTOPENIA: CORRECTION OF PROTHROMBIN CONSUMPTION WITHOUT CORRECTION OF BLEEDING. P. F. Hjort, V. Perman, and E. P. Cronkite (Brookhaven National Lab., Upton, N. Y.). Proc. Soc. Exptl. Biol. Med. 102, 31-5(1959) Oct.

When irradiated dogs developed severe thrombocytopenia and purpura, the thoracic duct was cannulated and output of red cells/minute counted to quantitate bleeding tendency. Fresh canine platelets disintegrated in a sonic oscillator and infused into the dogs increased prothrombin consumption towards the normal range, but had no effect on bleeding tendency. Intact platelets, however, had an immediate and dramatic effect on bleeding tendency. We conclude that a normal clotting system, including platelet factors, is not enough for normal hemostasis; the mechanical effect of intact platelets is also needed. Consequently, non-intact platelets or platelet substitutes may not be expected to improve the bleeding tendency in thrombocytopenia. (auth)

1385

EFFECT OF X-IRRADIATION ON SPLEEN NUCLEOTIDE LEVELS. Edwin M. Uyeki (Univ. of Chicago). Radiation Research 11, 617-24(1959) Nov.

Results are reported from studies on the effects of lethal and sublethal doses of radiation on the spleen adenosine nucleotide levels of rats, mice, and guinea pigs. The adenosine nucleotides were separated from tissue samples by ion-exchange chromatography using Dowex-1 resin. The predominant change produced by whole-body exposure to 400 to 800 r of x radiation was on the adenosine triphosphate levels. Less significant changes were noted in the total adenosine nucleotide, adenylic acid, and adenosine diphosphate levels of the spleen. Data are presented graphically on nucleotide levels measured for 14 days after exposure. (C.H.)

1386

MONOLAYER TECHNIQUE TO STUDY EFFECTS OF IONIZING RADIATIONS ON HISTONE. K. S. Korgaonkar and Anasuya M. Desai (India Cancer Research Center, Bombay). Radiation Research 11, 625-35(1959) Nov.

The monolayer techniques developed by Langmuir for interphase and thin film studies were adapted to study the effects of beta-gamma radiations on the protein histone in dilute aqueous solutions. A trough and float system is described and illustrated with a schematic sketch. The monolayer properties of histone were studied prior to and after irradiation with beta-gamma radiations from radon glass capillaries. Changes in the surface properties of histone, monolayers are described. From the observed changes it was concluded that irradiation produces a degree of fragmentation and some modifications in the histone molecules, which cause hydrophilic groups to go into the aqueous under phase and results in lowering of the residual charges carried by the molecules in the monolayer. (C.H.)

1387

THE INFLUENCE OF OXYGEN ON THE SENSITIVITY OF TRADESCANTIA POLLEN TUBE CHROMOSOMES TO X-RAYS. H. J. Evans and G. J. Neary (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Radiation Research 11, 636-41(1959) Nov.

The effect of oxygen concentration on the yield of isochromatid aberrations induced by x radiation was studied in isolated Tradescantia pollen tubes. Data are presented graphically on the relation between radiosensitivity and oxygen concentration. (C.H.)

1388

INFLUENCE OF 31-Mev X-RAYS ON EXCRETION OF NITROGEN COMPOUNDS IN SPLEEN ISOLATED FROM IRRADIATED GUINEA PIG. A. Dekleva-Likar, D. Lebez, and L. Strauch (J. Stefan Inst., Ljubljana, Yugoslavia). Radiation Research 11, 648-52(1959) Nov.

Results are reported from an investigation of the excretion of nitrogen compounds from the isolated spleen of guinea pigs after whole-body irradiation. Data are tabulated on the excretion of nitrogen compounds after exposure to 100, 200, 400, or 500 r x radiation. Observations show a striking change in the permeability of the cell membranes which might give rise to marked changes in the organism. (C.H.)

1389

X-IRRADIATION OF THE EXTERIORIZED OR IN SITU INTESTINE OF THE RAT. M. F. Sullivan, S. Marks, P. L. Hackett, and R. C. Thompson (General Electric Co., Richland, Wash.). Radiation Research 11, 653-66 (1959) Nov.

The in situ or surgically exteriorized gastrointestinal tracts of rats were exposed to 250-kvp x radiation. Comparisons were made of these two modes of exposure with respect to mortality, hematologic injury, and histologic damage. Data are presented graphically. (C.H.)

1390

THE RELATIVE BIOLOGICAL EFFECTIVENESS OF Co^{60} GAMMA RAYS AND FISSION NEUTRONS: LETHAL EFFECTS ON THE 4-DAY CHICK EMBRYO. Howard H. Vogel, Jr. and Donn L. Jordan (Argonne National Lab., Lemont, Ill.). Radiation Research 11, 667-83(1959) Nov.

The comparative effects of fission neutrons and cobalt-60 gamma rays were studied using the lethality test in the 4-day-old chick embryo. The relative biological effectiveness of fission neutrons relative to cobalt-60 gamma rays was 2.2 for this effect under the conditions employed. Methods and results are discussed. It was concluded that the chick embryo test is an easy and reliable biological test with which to compare different qualities and energies of ionizing radiations. (C.H.)

1391

BIOCHEMICAL CHANGES IN BETA-IRRADIATED EPIDERMIS OF GUINEA PIGS. Joseph Tabachnick and Charles Weiss (Albert Einstein Medical Center, Philadelphia). Radiation Research 11, 684-99(1959) Nov.

An investigation was made of the concentrations of water, total protein, total free amino acids, ammonia, urocanic acid, deaminated histidine, DNA, and RNA in epidermis during the latent and acute stages and the healing period after beta irradiation. Histologic changes observed are described. Data are tabulated on biochemical changes. Eighteen free amino acids were isolated from untreated and irradiated epidermis and their pattern was shown to be unaffected by radiation. Since increases in concentrations of total free amino acids and urocanic acid of epidermis occur in spite of the fact that the sebaceous glands and apocrine sweat glands have been destroyed by irradiation, it is tentatively concluded that these compounds do not originate to any significant degree from the organelles in the dermis. (C.H.)

1392

INITIAL DEPLETION AND SUBSEQUENT RECOVERY OF SPERMATOGONIA OF THE MOUSE AFTER 20 R OF GAMMA RAYS AND 100, 300, AND 600 R OF X-RAYS. E. F. Oakberg (Oak Ridge National Lab., Tenn.). Radiation Research 11, 700-19(1959) Nov.

Results are reported from a series of studies on mice which support earlier conclusions that killing of cells is the primary factor in radiation-induced depletion of spermatogonia. Data are tabulated and discussed. (C.H.)

1393

THE EFFECTS OF X-RADIATION ON THE EARLY CLEAVAGE STAGES OF THE SNAIL, ILYANASSA OBSOLETA. James N. Cather (Univ. of Michigan, Ann Arbor). Radiation Research 11, 720-31(1959) Nov.

The relative sensitivity of the various mitotic stages to x radiation was measured by the cleavage delay produced in the eggs of the snail, Ilyanassa obsoleta. The duration of the various mitotic stages after irradiation were compared with the normal. Data are tabulated. (C.H.)

1394

ACTION OF X RADIATION AND PEROXIDE ON BARLEY SEED AND SOME CRYPTOGAMS. Jean Moutschen (Université, Liège). Radiobiol. Latina 2, 15-36(1959) Jan.-Mar. (In French)

When dry barley seeds are irradiated with large doses of x radiation, a reversion of the curve of coleoptile heights is noticed. This reversion is caused by a cellular elongation increasing with the dose, as is also shown in experiments with algae, mosses, and ferns. The effects of hydration, latency time, temperature, and radioprotective substances on the radiosensitivity of the seed was studied. The cellular elongation increases with the dose except at extreme temperatures (–15 to 40°C) and on the incorporation of cystamine after irradiation. No other factors increase the cellular elongation. The effect of hydrogen peroxide is analogous to that of the x radiation, and, on this basis, a hypothesis is discussed. (tr-auth)

1395

EFFECTS OF X RADIATION AND HORMONE THERAPY ON THE EPITHELIUM OF THE GENITAL TRACT OF CASTRATED ANIMALS. P. Lamarque and J. Gary-Bobo (Faculté de Médecine, Montpellier). Radiobiol. Latina 2, 45-52(1959) Jan.-Mar. (In French)

The modifications of the epithelium of the genital tract of castrated female guinea pigs caused by the effects, single or combined, or x radiation and hormone therapy (estrogens only) were studied. Depending on the dose injected and the time of injection a mucification of the genital mucosa is obtained. Radiation alone causes an increase of the cellular volume and the nucleus, but with a reduction of the mucosa which sometimes even disappears. Radiation, administered immediately after the estrogens or 24 hours later, appears to reduce the mucigenous effect of the estrogens. The mucosa is thicker with large cellular nuclei, but few mucous cells. Radiation given 24 hours before the estrogens appears to have no effect on the action of the hormone and large mucous zones are evident. These results are compared with the slightly different results obtained in similar work on rats. (J.S.R.)

1396

INVESTIGATION ON THE ALKALINE PHOSPHATASE OF THE ADRENAL GLAND OF THE RAT EXPOSED TO WHOLE-BODY X RADIATION AND TREATED WITH CYSTEAMINE. A. Pasqualino, E. Nesci, and U. Nuvolone (Università Messina, Italy) and (Ospedale Maggiore Novara, Italy). Radiobiol. Latina 2, 53-74(1959) Jan.-Mar. (In Italian)

The effects of whole-body x radiation, cysteamine, and radiation after injection of cysteamine on the alkaline phosphatase in the adrenal gland of the rat were studied by the Glick-Gomori method. Under normal conditions alkaline phosphatase can be shown histochemically in the glomerular, external fascicular, and X zones of the cortex, but none can be seen in the medulla. Whole-body x radiation causes the disappearance of the alkaline phosphatase for several days, but after 168 hours a return of the enzyme activity of the outer layers of the cortex is noticed. Treatment with cysteamine causes an increase of alkaline phosphatase in all layers of the cortex and involving chiefly the adventitia of the capillaries. Treatment with cysteamine before irradiation prevents the decrease in the enzyme activity which occurs after irradiation of the non-protected animal. (tr-auth)

1397

VARIATIONS IN THE AREA OF THE NUCLEUS OF LYMPHOCYTES DURING TELECOBALT THERAPY. M. Sforza, M. Vaccheri, and C. Mangioni (Università Pavia, Italy and Università, Milan). Radiobiol. Latina 2, 75-9 (1959) Jan.-Mar. (In Italian)

The amount of DNA in the nuclei of lymphocytes of patients undergoing telecobalt therapy was determined histophotometrically, and the nuclei of the lymphocytes were measured planimetrically in other patients undergoing similar treatment and in rabbits exposed to whole-body Co^{60} radiation of 200, 400, and 600 r. In every case a decrease in the nuclear area was found after gamma radiation. (tr-auth)

1398

CONTENTS OF PYRIDINE NUCLEOTIDES AND THE LACTODEHYDROGENASE ACTIVITY IN THE LIVER OF IRRADIATED RATS. V. Mattai Del Moro (Università, Milan). Radiobiol. Latina 2, 99-103(1959) Jan.-Mar. (In Italian)

The behavior of pyridine nucleotides and lactodehydrogenase in the liver of irradiated rats was studied. A decrease in the contents of these substances was found. The significance of these modifications with respect to the mechanism of lesions produced by irradiation is discussed. (tr-auth)

1399

THE BEHAVIOR OF AN ENZYME SYSTEM BEFORE AND AFTER X RADIATION. A CONTRIBUTION TO THE RADIOBIOLOGICAL PROBLEMS OF THE TIME FACTOR AND RECOVERY. Otto Hug and Irmgard Wolf (Max Planck-Institut für Biophysik, Frankfurt am Main). Strahlentherapie Sonderbände 35, 209-19(1956). (In German)

If one evaluates radiation effects on living organisms, the physiological turnover of radiosensitive body constituents has to be taken in account. Some theoretical calculations concerning the effect of radiation on open systems and new interpretations of time intensity factor and recovery are presented. Experimental proof for these calculations was given by the irradiation of luminous bacteria and the simultaneous measurement of the light emitted by them. (auth)

1400

THE RESTORATION OF MARROW FUNCTION AFTER LETHAL IRRADIATION IN MAN: A REVIEW. George Mathé (Hospital Herold, Paris); E. Donnall Thomas and Joseph W. Ferrebee (Mary Imogene Bassett Hospital, Cooperstown, N. Y. and Columbia Univ., N. Y.). Transplantation Bull. 6, 407-9(1959) Oct.

The restoration of marrow function in man after lethal irradiation is discussed. The effectiveness of infusions of cells of normal marrow in the restoration of bone marrow function is reported following exposure to doses of from 600 to 1140 r. Best results were obtained when the infusions were given one, two, or even three weeks after irradiation. Case histories are reviewed. (C.H.)

1401

ISOANTIGENICITY OF X-RAY-INACTIVATED IMPLANTS OF A HOMOTRANSPLANTABLE AND A NONHOMOTRANSPLANTABLE MOUSE SARCOMA. Eva Klein (Inst. for Cell Research and Genetics and Inst. for Tumor Biology, Karolinska Instutet Medical School, Stockholm). Transplantation Bull. 6, 420-4(1959) Apr.

Data are tabulated on hemogylutin titers in mice injected repeatedly with heavily irradiated tumor cells and tested against erythrocytes from a hybrid mouse strain, and on the growth of two different tumors in mice immunized by a single inoculum of heavily irradiated cells. Factors affecting the growth of transplanted tumors are discussed. (C.H.)

1402

A RADIATION TARGET STUDY OF THREE ENZYME ACTIVITIES OF XANTHINE OXIDASE. Donald J. Fluke (Brookhaven National Lab., Upton, N. Y. and Donner Lab., Berkeley). p.161-8 of "Proceedings of the First National Biophysics Conference." Henry Quastler and Harold J. Morowitz, eds. New Haven, Yale University Press, 1959. 815p.

The radiation targets for three activities of xanthine oxidase of cow's milk were investigated by irradiating dry preparations of the enzyme with 40-Mev alpha particles or other radiations and recovering the enzyme into solution in buffer. All three activities, purine, aldehyde, and diphosphopyridine nucleotide oxidation show the same target size. Solubility of the enzyme is discussed. (C.J.G.)

1403

PRODUCTION OF SULFHYDRYL GROUPS AS A RESULT OF THE INDIRECT OR DIRECT EFFECT OF IONIZING RADIATION. Rosalyn S. Yalow (Veterans Administration Hospital, Bronx, New York). p.169-73 of "Proceedings of the First National Biophysics Conference." Henry

Quastler and Harold J. Morowitz, eds. New Haven, Yale University Press, 1959. 815p.

The sulfur-containing amino acids, cystine, cysteine, and methionine in the dry state were bombarded with 4.2-Mev deuterons and in solution were irradiated with x rays of 1-Mev peak energy. Sulfhydryl group production was determined quantitatively by means of the Prussian blue reaction in the presence and absence of p-chloromercuribenzoate. Data from the experiments indicate that the -SH groups may be formed from -C-S- or -S-S- bonds by irradiation in the dry state or in solution. (C.J.G.)

1404

RESPONSES OF MAMMALIAN NERVES TO X-IRRADIATION. C. S. Bachofer (Univ. of Notre Dame, Ind.). p.371-6 of "Proceedings of the First National Biophysics Conference." Henry Quastler and Harold J. Morowitz, eds. New Haven, Yale University Press, 1959. 815p.

Electrophysiological recordings from x-irradiated, isolated caudal nerves of the rat during irradiation showed unexpected increases in spike amplitude with slight increases in conduction velocity and sensitivity before deterioration set in. The conduction velocity consistently fell after a brief initial rise while the spike amplitude continued to rise. This fact suggests that conduction velocity and spike amplitude are controlled by different mechanisms in so far as their responses to x-irradiation are concerned. Two competing phenomena appear to be involved during irradiation: one is manifested in the enhanced activity of the nerves while the other is manifested in the destruction of the activity of the nerve. An optimal dose rate will emphasize the former before the latter is able to obscure it. An extension of the work to nerves in vivo confirmed the striking increase noted in vitro. A further extension of the work to the single median giant axon of the earthworm again demonstrated an enhanced activity and a lowered threshold to stimulation as a result of x-irradiation. (auth)

1405

QUALITY OF RADIATION AND SELECTIVITY OF BIOLOGICAL EFFECTS. Henry Quastler (Brookhaven National Lab., Upton, N. Y.). p.704-14 of "Proceedings of the First National Biophysics Conference." Henry Quastler and Harold J. Morowitz, eds. New Haven, Yale University Press, 1959. 815p.

An empirical relation between quality and selectivity of ionizing radiations is stated. To explain it, an atomistic model of the action of radiation upon living matter is introduced. The biological element considered is a target, defined in a very general way. Its sensitivity is described by a set of conditional probabilities of a given response following the absorption of a given amount of energy. The probability of a particle losing a given amount of energy while passing through a target is related to its rate of linear energy transfer (LET), and the probabilities of a particle having a given LET at a given moment are derived from a simple LET-range relation. Using this model, and some simplifying assumptions, the empirical relation stated is derived. (auth)

1406

THERAPIE MIT RÖNTGENSTRAHLEN UND RADIOAKTIVEN STOFFEN. (Therapy with X Radiation and Radioactive Materials). Hans-Joachim Fiebelkorn and Walter Minder. Bern and Stuttgart, Verlag Hans Huber, 1959. 441p.

This book on radiotherapy is intended as a handbook for radiologists and general practitioners. It is divided into two sections: Radiomedicine and Physical Basis of Radiation Therapy and Dosimetry. In the first section consideration is given to The Basic Process in the Physical and Biological Effect of Ionizing Radiation, The Elementary Possible Therapeutic Effects of X Radiation, The Necessity of An Aimed Beam at High Doses and the Methods Available, Practical Application Area for Small Doses, and Practical Application Area for Average and High Doses. The second section presents discussions on Technical Means of Radiation Therapy, Beams of Radiation Therapy, Interaction Between Radiation and Matter, General Principles of Radiation Dosimetry, Characterization of Various Radioactive Materials and Natural Radioelements, and Protection Problems in Radiation Therapy. 786 references. (J.S.R.)

1407

RESULTS OF EXPERIMENTS ON THE BIOLOGICAL EFFECTS OF COSMIC RADIATION ON SEEDS OF HORDEUM BONUS 01518/B19 GUSTAFSSON, WITH SPECIAL CONSIDERATION ON THE EFFECTS OF HEAVY PRIMARIES. J. Eugster (Universität, Zurich); R. Koblet (Instituts für Pflanzenbau, ETH, Zurich); and David Simons (U. S. Air Force, Holloman, N. Mex.). p.222-4 of "IXth International Astronautical Congress, Amsterdam, 1958, Proceedings. [Vol.] I." F. Hecht, ed. Vienna, Springer-Verlag, 1959. p.1-506.

Hordeum seeds were exposed to cosmic radiation in the course of several flights at altitudes of 30,000 and 40,000 m for an average period of 32 hours. The filial generations of these seeds were subjected to thorough observation and results are given. (W.D.M.)

Radiation Sickness

1408 AEC-tr-3767

PROBLEMS OF INFECTION, IMMUNITY, AND ALLERGY IN ACUTE RADIATION SICKNESS. (Voprosy Infektsii, Immuniteta i Allergii pri Ostroĭ Luchevoĭ Boleznĭ). N. N. Klemparskaya, O. G. Alekseyeva, R. V. Petrov, and V. F. Sosova. Translated from a publication of the State Publishing House for Medical Literature, Moscow, 1958. 140p. OTS.

Results are reported from a series of studies on laboratory animals of the interrelations between irradiated animals and bacteria. Both auto-infection and infection caused by pathogenic bacteria were studied. The nature of immune and allergic reactions were investigated. (C.H.)

1409 JPRS-1321-N

THE EFFECT OF SURROUNDING TEMPERATURE ON THE COURSE OF RADIATION SICKNESS (AN EXPERIMENTAL INVESTIGATION). L. N. Mushina-Udgodskaya. Translated from Vestnik Rentgenol. i Radiol. 33, No. 3, 23-7(1958). 8p. OTS.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 2688.

1410 JPRS-1409-N

THE SURGICAL TREATMENT OF WOUNDS OF SOFT TISSUES IN RADIATION SICKNESS. A. I. Morozov. Translated from Vestnik Rentgenol. i Radiol. 33, No. 2, 86-7(1958). 3p. OTS.

Clinical aspects of soft tissue wounds in animals subjected to various doses of ionizing radiation are considered. Also, the possibility of primary wound closure in the first 24 hours after trauma, as well as the possibility of delayed primary and secondary closure at various periods in radiation sickness are studied. Experimental techniques and results are described. (J.R.D.)

1411 JPRS-L-692-N
THE PROBLEM OF THE METABOLISM OF VITAMIN C AND AROMATIC AMINO ACIDS IN RADIATION SICKNESS. M. M. Stepanova and I. I. Ivanov. Translated from Voprosy Med. Khim. 4, 370-2(1958). 6p. OTS.

No serious disturbances in metabolism of the amino acids or marked changes in vitamin C levels were observed during radiation sickness in guinea pigs. (C.H.)

1412 JPRS-L-836-N
THE PROBLEM OF THE THERAPEUTIC ACTION OF STRYCHNINE IN ACUTE RADIATION SICKNESS IN RATS AND MICE. E. K. Grabovenko and M. F. Sbitneva. Translated from Patalog. Fiz. i Eksptl.' Terap. 3, 71(1959). 3p. OTS.

No positive influence on survival was observed in irradiated mice and rats treated with subcutaneous doses of strychnine. A positive influence on the higher nervous activity of the animals was observed. (C.H.)

1413 JPRS(NY)-L-438
ROENTGEN KYMOGRAPHY OF THE HEART IN ACUTE EXPERIMENTAL RADIATION SICKNESS. I. B. Gurevich. Translated from Med. Radiol. 2, No. 6, 49-55(1957). 13p. OTS.

Changes in the cardiovascular system during acute radiation sickness were studied in dogs. Changes in the contractile function of the myocardium are described which were found to correspond in time to development and recovery from radiation sickness. Roentgen kymography was found useful in evaluating changes of the contractile function of the myocardium. (C.H.)

1414 JPRS(Y)-L-439
TREATMENT OF ACUTE RADIATION SICKNESS IN DOGS BY DRIP BLOOD TRANSFUSIONS. A. N. Gamaleya, A. A. Gyurdzhian (Gyurdzhiyan), A. A. Zhgun, and P. V. Simonov. Translated from Med. Radiol. 2, No. 6, 56-60(1957). 9p. (PB-141338-T). OTS.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 5192.

1415 SCL-T-280
TRANSFUSIONS AND GRAFTINGS OF HOMOLOGOUS BONE MARROW IN HUMANS WHO HAVE BEEN ACCIDENTALLY IRRADIATED WITH HIGH DOSAGES (OF RADIOACTIVITY). (Transfusions et Greffes de Moelle Osseuse Homologue Chez des Humains Irradiés a Haute Dose Accidentellement). G. Mathé, H. Jammet, B. Pendic, et al. Translated by Marcel I. Weinreich (Sandia Corp.) from Rev. franç. études clin. et biol. 4, 226-30(1959). 24p. JCL.

Five patients who had been accidentally exposed to very high doses of neutrons and gamma-radiations were treated with intravenous administration of marrow cells. A rapid clinical improvement followed and a concomitant correction of bone marrow and blood cytopenia occurred. Several facts bring the authors to think that the production of blood cells was assumed for about a month by the grafted bone marrow, the most convincing of them being the result of the study of the phenotypes of red cells produced, respectively, by the grafted marrow and the own hemopoietic tissue of the patients. (auth)

1416
CERTAIN PROBLEMS OF THE CLINICAL PICTURE AND COURSE OF ACUTE RADIATION SICKNESS IN MONKEYS. A. A. Bagdasarov, M. O. Raushenbach, G. V. Sukyasyan, G. M. Abdullaev, M. N. Novikova, N. Ya. Lagutina, N. L. Samoilina, and G. A. Chernov. Med. Radiol. 4, 17-24(1959) Sept. (In Russian)

The authors studied the course of acute radiation sickness in 8 monkeys (Macacarhesus) subjected to single whole-body x irradiation (in the dose of 540 r). Four monkeys underwent treatment with polyvinylpyrollidon, colloid infusin, thrombocytic mass, hemostimulants, and other pharmacological substances. Four monkeys served as control. All monkeys developed acute radiation sickness with manifestations of toxemia and characteristic changes in the peripheral blood and bone marrow. There were observed regular changes in the coagulating system of the blood, as well as in the content of serotonin and properdin in the blood. The control monkeys perished in the course of the first two weeks following irradiation, while all the treated monkeys survived. At the 40th day following irradiation the indices of hemo- and myelogram in the monkeys treated reached the initial values. Clinically the monkeys were absolutely healthy. (tr-auth)

1417
PROPHYLACTIC USE OF CERTAIN SULFHYDRYL SUBSTANCES IN EXPERIMENTAL RADIATION AFFECTIONS. E. A. Mukhin. Med. Radiol. 4, No. 9, 29-33(1959) Sept. (In Russian)

In the comparative study of various protective substances, such as salts of β-mercaptoethylamine, and its derivatives, isothiurone compounds, it has been established that the toxicity of preparations of β-mercaptoethylamine and β-aminoethylisothiuronium depends upon the acid part of the compound. The value of the protective effect of these substances is determined by the acid part of the compound, the dosages, the time of introduction, and the length of the observation. These substances lowered the blood pressure by stimulating the parasympathetic innervation. With the substitution of amino-group hydrogens of β-mercaptoethylamine and β-aminoethylisothiuronium by methylic and ethylic radicals, the preparations lose their protective properties. β-mercaptoethylamine, β-aminoethylisothiuronium, and ethylisothiuronium, when used in effective protective doses, possess a hypothermic and antidiuretic action. There is no parallelism between these properties and the strength of the protective effect of the above agents. (tr-auth)

1418
PHARMACOLOGICAL ASPECTS OF IONIZING RADIATION AND OF CHEMICAL PROTECTION IN MAMMALS. Alexander Pihl and Lorentz Eldjarn (Norsk Hydro's Inst. for Cancer Research, Oslo). Pharmacol. Revs. 10, 437-74 (1958) Dec.

A review is presented on pharmacology and chemical radiation protection with emphasis on effects of the protective agents in mammals. 244 references. (T.R.H.)

1419
A STUDY OF THE RÔLE OF SEROTONIN (5-HYDROXYTRYPTAMINE) IN THE PATHOGENESIS OF ACUTE RADIATION SICKNESS. SEROTONIN ACTIVITY OF THE ANIMAL BLOOD IN ACUTE RADIATION SICKNESS. M. O. Raushenbakh and G. A. Chernov (Lenin Inst. of Hematology and Blood Transfusion, Ministry of Health, USSR). Problems Hematol. Blood Transfusion (USSR) (English Translation) 4, No. 3, 1-10(1959).

Serotonin, or 5-hydroxytryptamine, is a biological amine derived from indole which is widespread in organs and tissues. Physiological and pharmacological properties of serotonin are discussed. Levels of serotonin activity during radiation sickness were measured in dogs, monkeys, guinea pigs, and rats. Phasic and species variations were observed. No conclusions were reached as to the role of serotonin in the pathogenesis or treatment of radiation sickness. (C.H.)

1420

A STUDY OF THE CONTENT, ABSORPTION AND DEPOSITION OF VITAMIN B_{12} IN THE LIVER IN RADIATION SICKNESS. G. D. Berdyshev (Tomsk Medical Inst., USSR). Problems Hematol. Blood Transfusion (USSR) (English Translation) 4, No. 3, 10-14(1959).

No perceptible changes were observed in the vitamin B_{12} content of liver and serum of experimental animals exposed to lethal and sublethal doses of radiation. (C.H.)

1421

THE RÔLE OF THE PLATELETS IN THE DEVELOPMENT OF THE HEMORRHAGIC SYNDROME IN RADIATION SICKNESS. A. S. Petrova. Problems Hematol. Blood Transfusion (USSR) (English Translation) 4, No. 3, 15-19 (1959).

The course of radiation sickness caused by external exposure to x rays and by internal implantation of strontium-90 and polonium-210 was studied. Changes in platelet count and in clot retraction index were observed. The development of the hemorrhagic syndrome was followed. Certain distinctive features resulting from the difference in form and type of radiation were noted. These changes are described. (C.H.)

1422

A STUDY OF THE EFFECT OF TRANSFUSION OF POLYVINYLPYRROLIDONE ON THE COURSE OF ACUTE RADIATION SICKNESS. G. V. Sukiasian, N. S. Dzhavadian, M. N. Novikova, B. F. Beliayeva, N. A. Probatova, and M. G. Shitikova (Lenin Inst. of Hematology and Blood Transfusion, Ministry of Health, USSR). Problems Hematol. Blood Transfusion (USSR) (English Translation) 4, No. 3, 62-71(1959).

Results are reported from a study of the effect of transfusions of low-molecular preparation of polyvinylpyrrolidone on the course of acute radiation sickness in dogs and mice. The results confirm the high detoxicating power of this compound. Transfusions of polyvinylpyrrolidone diminished the development of a hemorrhagic syndrome but did not prevent the development of radiation anemia. The transfusions lessened the severity of the course of radiation sickness and prolonged the lives of the animals. (C.H.)

1423

FACTORS INFLUENCING THE RADIOPROTECTIVE ACTION OF CYSTEINE: EFFECTS IN ESCHERICHIA COLI DUE TO DRUG CONCENTRATION, TEMPERATURE, TIME, AND pH. Henry I. Kohn and Shirley E. Gunter (Univ. of California, San Francisco). Radiation Research 11, 732-44(1959) Nov.

The magnitude of the radioprotective action of cysteine in Escherichia coli was measured as a function of drug concentration, pH, temperature, and duration of drug exposure. Results are tabulated and discussed. (C.H.)

1424

RADIOISOTOPE SCANNING. G. L. Brownell (Massachusetts General Hospital, Boston). p.59-72 of "Proceedings of the First National Biophysics Conference." Henry Quastler and Harold J. Morowitz, eds. New Haven, Yale University Press, 1959. 815p.

A general analysis of the problem of rectilinear scanning of radioisotope distributions within the human body is developed. A plate is contained illustrating a single channel scan with cylindrical aperture of Au^{198}-labeled carbon particles infused into the brain of a dog by intracarotid injection. Plates are given illustrating localization of brain tumors in humans by positron scanning. Geometrical efficiencies are calculated for single cylinder, single taper, and focus collimators and for a coincidence detector. (C.J.G.)

1425

INTRANUCLEAR IRRADIATION WITH TRITIUM-LABELED THYMIDINE. J. S. Robertson and W. L. Hughes (Brookhaven National Lab., Upton, N. Y.). p.278-84 of "Proceedings of the First National Biophysics Conference." Henry Quastler and Harold J. Morowitz, eds. New Haven, Yale University Press, 1959. 815p.

Calculations are given on the radiation dose delivered to a cell nucleus by beta particles from tritium-labeled thymidine. It was determined that a single disintegration of tritium gives an average of 53.5 rad to the inner 0.5 μ radius sphere and 5.8 rad to the next 0.5 μ shell. Ten per cent of the total disintegrations have energies of 2 to 3 kev and deliver 82.5 rad per single disintegration in the inner 0.5 μ radius sphere. (C.J.G.)

CHEMISTRY

General and Miscellaneous

1426 A-1084

Mallinckrodt Chemical Works, St. Louis.

CHANGES IN EXTRACTORS TO PREVENT EMULSIONS. H. V. Farr, C. D. Harrington, J. A. Kyger, R. R. Midlam, W. C. Rosenbaum, H. E. Thayer, H. L. Wibbels, and H. Yeager. May 25, 1945. Decl. Sept. 30, 1959. 34p. OTS.

A laboratory-scale extractor was built and used to study the breaking of emulsions. A random experiment led to the discovery that by pumping ether layer and bottom of extractor simultaneously in the proper ratio (during recycling) the emulsion is broken up. The production extractors were then modified. The experiments and resultant modifications are described. (T.R.H.)

1427 AECU-4424

General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.

APPLICATIONS OF RARE EARTHS TO FERROUS AND NON-FERROUS ALLOYS. J. F. Collins, V. P. Calkins, and J. A. McGurty. Nov. 2, 1959. 26p. OTS.

Presented at American Society for Metals-Atomic Energy Commission Symposium on the Rare Earths and Related Metals, Chicago, Illinois.

The applications for rare earths as mixed metals or their oxides in the steel industry have multiplied rapidly in the past decade and are now providing a variety of alloys with markedly improved properties. This phase of rare earth development is well established. As for the individual rare earth elements and their effect on ferrous and nonferrous alloys, the information is still of a qualitative nature. The number of organizations that are producing rare earth metals has increased rapidly in the past few years. All of the rare earths except promethium are available in pound quantities and some of the lighter rare earths, especially yttrium, dysprosium and gadolinium, are being produced in ton quantities. The work reviewed in this paper has served to define a few applications which have a great potential. However, the extent to which producers will find a market for the rare earth metals depends on the ability of industry to translate laboratory results to useful high volume product applications. (auth)

1428 AFOSR-TN-59-1093
Princeton Univ., N. J. Aeronautical Engineering Lab.
METAL COMBUSTION PROCESSES. Aeronautical Engineering Laboratory Report No. 473. Irvin Glassman. Aug. 1959. 43p. Contract AF18(600)-1527.

Since the light metallic elements undoubtedly will play a greater and greater role as propellants in advanced chemical and nuclear-chemical propulsion systems, interest in their burning characteristics is increasing. Presented here are some preliminary conclusions on burning characteristics. These conclusions are based on fundamental physical considerations and not on experimental results. An analytical approach to calculate the burning rate of metals is also suggested. This approach differs from the diffusion-droplet approach in that it includes radiation feed-back and loss terms. Such terms can be important at the high temperatures of the diffusion film surrounding a burning metal. (auth)

1429 ANL-5789(Del.)
Argonne National Lab., Lemont, Ill.
CHEMICAL ENGINEERING DIVISION SUMMARY REPORT [FOR] JULY, AUGUST AND SEPTEMBER 1957. Dec. 1957. Decl. with deletions Aug. 8, 1958. 135p. Contract W-31-109-eng-38. OTS.

Fluoride Volatilization Separations Processes. The testing of graphite as a container material for the hydrofluorination step was continued. Studies were conducted on the dissolution rates of Zr and Zr alloys in molten $NaF-ZrF_4$. Experiments were performed with macro quantities of inactive Nb to clarify its behavior as a fission product in the fused salt process. The thermal stability of non-volatile UF_6-KF compound was investigated. Further data were obtained on the reactions of plutonium fluorides. A study of the fractional distillation of $BrF-UF_6$ mixtures was made. An evaluation was made of corrosion coupons of monel, nickel, type 304 stainless steel, and mild steel. Fluidization Studies. Development of a fluidized-bed process for production of UF_4 from refined $UO_2(NO_3)_2$ solution was resumed. The waste calciner was operated to study the effect of calcination temperature on volatilization of Ru from diluted ICPP waste. Work continued on a potential method for separation of U from Zr alloy fuel by dissolution, calcination, and fluorination. Reactor Chemistry. The program to clarify the factors governing the pyrophoric characteristics of U, Zr, Th, and Pu has continued. Isothermal oxidation kinetics of Zr are not changed by oxygen pressure nor by various surface preparations on parallelepiped samples. Alloys of Sn and Pt have shown breakaway phenomena after a period of time. Fission yields at mass 89, mass 137, and mass 140 were determined for fast fission of Pu^{239}. Chemical-Metallurgical Processing. Pyrometallurgical methods of reprocessing discharged nuclear reactor fuel are being developed. An investigation of factors affecting the distribution of Zr in melt-refined products of equilibrium "fissium" materials was initiated. An investigation has begun to determine the feasibility of purifying metallic materials by solution in a metallic solvent, followed by a series of physical or chemical operations. Studies of the ternary phase diagram (Zn-U-Pu) were undertaken to determine the separability of U and Pu. The coprecipitation of Pu with U-Zn intermetallic compounds was studied. Several studies are underway to determine thermodynamic properties of solutions and solids in the U-Zn system. Testing of methods and equipment for trapping volatilized metals (Na and Ce) was continued. Analytical Research and Services. Methods for chromatographic separation of Se, Te, Po, and Bi are presented. (W.L.H.)

1430 CCC-454-TR-294(Suppl.)
Callery Chemical Co., Penna.
STANDARD X-RAY DIFFRACTION POWDER PATTERNS. H. G. Norment, R. L. South, and P. I. Henderson. Oct. 10, 1959. 22p. Project ZIP. Contract NOa(s)-58-454-d.

A collection of twenty-two standard x-ray-diffraction powder patterns, mostly of boron compounds, is presented. The data were collected by both diffractometer and Debye-Scherrer methods. (auth)

1431 CF-59-8-95
Oak Ridge National Lab., Tenn.
THE COMPOUND $CuO \cdot 3UO_3$. J. S. Gill and W. L. Marshall. Aug. 25, 1959. 12p. OTS.

A double oxide of uranium and copper was found to exist at 300°C in the four-component system $UO_3-CuO-SO_3-H_2O$. This new compound is shown to be $CuO \cdot 3UO_3$. The method of preparation, analyses, and characterization of the compound are given. Some comments are made with regard to the homogeneous reactor fuel solution. (auth)

1432 BM-RI-5525
Bureau of Mines.
THERMOCHEMISTRY OF SAMARIUM. Robert L. Montgomery and Theodore D. Hubert. May 1959. 11p.

Heats of solution of samarium (III) oxide and chloride in hydrochloric acid and of samarium (III) oxide, sulfate, and hydrated sulfate in sulfuric acid were measured. The heats of solution of this hygroscopic oxide are larger than those from the literature, probably because of more complete removal of water in the present study. From the literature value for the heat of combustion of samarium, the heats of formation of samarium (III) chloride and sulfate are -244.18 ± 0.41 and -928.5 ± 1.6 kcal/mole, respectively. The heat of hydration of the sulfate is -34.7 ± 1.0 kcal/mole. The heats of formation of other samarium compounds have been recalculated, using the new data. (auth)

1433 JEN-24
Spain. Junta de Energia Nuclear, Madrid.
PRODUCCIÓN INDUSTRIAL DE URANIO. (Industrial Production of Uranium). Jovino D. Pedregal. 1956. 10p.

The purity requirements of uranium and the necessity of purifying the uranium compounds previous to its metallurgical treatment are briefly discussed as an introduction to the different methods reduction to the metal. The methods which are used by the Junta de Energia Nuclear are indicated. (tr-auth)

1434 JEN-36
Consejo Superior de Investigaciones Científicas.
Instituto de Química Física, Madrid and Spain. Junta de Energia Nuclear, Madrid.
SULPHURATION OF METALLIC SURFACES BY THIOUREA STUDY BY RADIOACTIVE TRACERS. J. Llopis, J. M. Gamboa, and L. Arizmendi. 1957. 14p.

A series of experiments to study the reaction between Cu metal and an aqueous solution of thiourea is reported. The thiourea used was labeled with S^{35}. Another series of experiments was performed with Pt metal. (W.L.H.)

1435 JEN-45
Spain. Junta de Energia Nuclear, Madrid.
EL CAMBIO DE ION Y SU RELACION CON LA INDUSTRIA. I. QUIMICA DE LOS CAMBIADORES DE ION MÉTODOS DE EMPLEO. (Ion Exchange and Its Relation with Industry. I. Chemistry of Ion Exchangers. Methods of Use). B. Lopez Perez, A. Huriarte Hueda, and L. Gutierrez Jodra. 1958. 21p.

The latest trends in the preparation of modern synthetic ion exchangers obtained by the treatment of polymerization and polycondensation products are reviewed. The physical and chemical characteristics, especially the stability, of exchangers are discussed. The utilization of ion exchangers in basic operations is described and illustrated with the results obtained in its application to the hydrometallurgy of uranium. The life of such materials are also considered. The most important synthetic commercial exchangers and their uses and properties are tabulated. (tr-auth)

1436 JEN-46
Spain. Junta de Energia Nuclear, Madrid.
CONTROL TERMOGRAVIMETRICO DE PRODUCTOS INTERMEDIOS DE LA METALURGIA DEL URANIO. (Thermogravimetric Control of Intermediate Products in the Metallurgy of Uranium). L. Gascó Sánchez and R. Fernández Cellini. 1959. 14p.

The thermal decomposition of some intermediate compounds in the metallurgy of uranium such as uranium peroxide, ammonium uranate, ammonium uranium pentafluoride, uranium tetrafluoride, and UO_2, were studied using Chevenard's thermobalance. Some data on the pyrolysis of synthetic mixtures of intermediate compounds which may appear during the industrial processing are given. Thermogravimetric methods of control are suggested for use in uranium metallurgy. (tr-auth)

1437 JEN-51
Spain. Junta de Energia Nuclear, Madrid.
ESTUDIOS SOBRE LA COMPOSICIÓN DE LOS SÓLIDOS EN LOS HUMOS DESPRENDIDOS EN EL PROCESO CALCIOTÉRMICO DE OBTENCIÓN DE URANIO. (Studies on the Composition of the Solids in the Fumes Released in the Calciometric Process for Uranium Production). A. Travesi, F. de la Cruz, and R. F. Cellini. 1958. 23p.

In the dust produced during the thermal reduction of uranium tetrafluoride with calcium, the existence of a beta activity which decays with time was confirmed. The activity was assigned to Th^{234}. An enrichment in Th^{234} of approximately 68% over the equilibrium value was found in the dust. An anomalous enrichment in the dust was found for the trace elements Zn, Sn, Pb, and Cu. No enrichment was detected for Fe and Ni. (tr-auth)

1438 MIT-OR-5
Massachusetts Inst. of Tech., Oak Ridge, Tenn. Engineering Practice School.
USES OF DEPLETED URANIUM. J. E. Donahue and A. E. Higinbotham. Nov. 5, 1959. 32p. For Oak Ridge National Lab. Contract W-7405-eng-26, Subcontract 70. OTS.

An extensive literature search was conducted for non-nuclear applications of uranium and its compounds. The purpose of the study was to find new commercial outlets for the large quantities of depleted uranium that are accumulating as a by-product of gaseous diffusion operations. A series of bibliographies was compiled for each proposed application and is presented in the report. A comparison of physical and chemical properties and consumption figures for uranium, chromium, lead, molybdenum, tungsten, and vanadium is also presented. (auth)

1439 NAA-SR-Memo-4187
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
VAPOR PRESSURE OF POLYPHENYL COOLANT AND COMPONENTS. F. C. Silvey. July 27, 1959. 13p. OTS.

Studies were undertaken to measure the vapor pressure of organic coolant materials over the temperature range 450 to 900°F. The vapor pressure of diphenyl, Santowax R, and ortho-, meta-, and para-terphenyl was determined experimentally. (W.L.H.)

1440 NP-8008
California Research Corp., Richmond, Calif.
ORGANIC MATERIALS FOR USE AS REACTOR MODERATOR-COOLANTS. R. O. Bolt, F. O. Johnson, and R. S. Kirk. June 13, 1956. 16p.

Physical and chemical properties of organic compounds considered for reactor moderator-coolants are tabulated and discussed. Included are compounds grouped in categories such as polyphenyls, fused ring aromatics, alkyl aromatics, miscellaneous, and mixtures. In addition, information on analytical methods, radiation effects, and handling safety is given. It is noted that data on some compounds and systems are limited. (J.R.D.)

1441 NP-8010
Florida. Univ., Gainesville. Engineering and Industrial Experiment Station.
THE PREPARATION OF FLUORINE-CONTAINING COMPOUNDS. Terminal Report. R. D. Dresdner, J. A. Wethington, and J. A. Young. Aug. 31, 1959. 22p. Contract Nonr 580(03).

The results of research in the chemistry of heteroatomic fluorocarbon derivatives are summarized. Results are presented for oxygen compounds, nitrogen compounds, sulfur compounds, and catalysis studies. References are given to publications in which more detailed information on the various compounds can be found. (J.R.D.)

1442 NP-8018
Midwest Research Inst., Kansas City, Mo.
DEVELOPMENT OF THERMALLY STABLE SILICON CONTAINING RESINS. Quarterly Progress Report No. 11 for June 15—September 18, 1959. Oct. 12, 1959. 31p. MRI Project No. 786-C. Contract AF33(616)-3675.

Continuing research on the preparation of silicon-containing polymers which are thermally stable and more rigid at elevated temperatures is described. In studies of the use of bulky groups, sodium hydroxide treatment of siloxanes containing one bulky group attached to silicon failed to significantly alter the properties of the materials. Also, attempts to synthesize bulky silane monomers based on the s-triazine ring were unsuccessful. When methods other than hydrolysis were examined for the formation of polymers from arylenedisilanes, ester elimination procedures appeared to be satisfactory. However, attempts to obtain the intermediate silanols for use as polymerization intermediates were not successful. Condensation of silanes and pentaerythritol or its derivatives failed to yield structures in yields useful in polymerization reactions. Additional studies of silicon-oxygen-titanium systems are described. (For preceding period see NP-7890.) (auth)

1443 NP-8022
Lehigh Univ., Bethlehem, Penna.
BASIC FACTORS IN THE FORMATION AND STABILITY OF NON-SOAP LUBRICATING GREASES. Quarterly Progress Report No. 8 for July 1, 1959 to September 30, 1959. Oct. 1959. 13p. Contract AF33(616)-3999.

Monthly report No. 28 is incorporated with this report, and will not be issued separately.

The investigation designed to determine the causes of structural instability of non-soap greases during use, and the application of the knowledge obtained to the production of superior greases has continued. Various techniques have been employed during this report period to increase the mechanical and temperature stability of greases containing various inorganic thickeners. Major success has been achieved here, apparently. Grease with excellent stability properties can be prepared with surface-modified thickeners. Surface modification is accomplished by deposition of phenol-formaldehyde type resins onto the surfaces of the solids in question followed by curing at elevated temperatures to a stable, coherent, though not necessarily, a monomolecular film. (auth)

1444 NRL-5364
Naval Research Lab., Washington, D. C.
SURFACE ACTIVITY OF FLUORINATED ORGANIC COMPOUNDS AT ORGANIC-LIQUID/AIR INTERFACES. PART II. SURFACE TENSION VS. CONCENTRATION CURVES, ADSORPTION ISOTHERMS, AND FORCE-AREA ISOTHERMS FOR PARTIALLY FLUORINATED CARBOXYLIC ESTERS. N. L. Jarvis and W. A. Zisman. June 17, 1959. 17p. Project NR 472-000.

Part I issued as NRL-5244.

This investigation was undertaken to study the ability of a series of partially fluorinated carboxylic esters to depress the surface tension of a group of pure organic liquids. The surface activity of these solutes in the different solvents was shown to vary with the hydrocarbon content, fluorocarbon content, and the number and position of associating groups in the solute. The balance between these organophilic and organophobic groups in the solute molecules which gave maximum surface tension depression varied with the surface tension of the solvent and the solubility of the solute in it. In this report surface tension vs. concentration curves, adsorption vs. concentration isotherms, and graphs of monolayer film pressure vs. area per molecule of adsorbed solute are given for each fluorochemical in the various organic solvents. Theoretical calculations from these data give the extent of adsorption and explain the orientation and packing of the molecules adsorbed at the interface of liquid and air. A discussion is given of the effect of the organophobic and organophilic constituents of the solute molecules on the extent of adsorption and on the tendency to associate with the various solvents. (auth)

1445 ORO-212
Carborundum Co. Research and Development Div.,
Niagara Falls, N. Y.
SYNTHESIS AND FABRICATION OF REFRACTORY URANIUM COMPOUNDS. Quarterly Report No. 1 [for] May 13 to August 31, 1959. K. M. Taylor, C. A. Lenie, P. A. Smudski, L. N. Hailey, and T. J. Keaty. Sept. 15, 1959. 30p. Contract AT(40-1)-2558. OTS.

Uranium monocarbide powder having a UC content of about 97% was produced by heating a mixture of UO_2 and carbon in a vacuum furnace at 1800°C. Uranium monocarbide pellets having a density of about 10 grams per cubic centimeter were prepared. A few experiments indicated that nitrogen contamination in the atmosphere probably aids sintering of UC. Small quantities of U_3Si_2 were produced by quenching U-Si melts from about 1700°C. (W.L.H.)

1446 ORO-213
Carborundum Co. Research and Development Div.,
Niagara Falls, N. Y.
SYNTHESIS AND FABRICATION OF REFRACTORY URANIUM COMPOUNDS. Monthly Progress Report No. 3 [for] September 1 to September 30, 1959. K. M. Taylor, C. A. Lenie, P. A. Smudski, L. N. Hailey, and T. J. Keaty. Oct. 6, 1959. 5p. Contract AT(40-1)-2558. OTS.

Additional experiments indicate the feasibility of producing a good grade of UC by reacting a stoichiometric mixture of UO_2 and C at atmospheric pressure. An exploratory experiment on producing UC from the reaction between $(NH_4)_2U_2O_7$ and C resulted in a product consisting of a mixture of UC and UC_2. Work on fabrication of UC by sintering and hot-pressing is in progress. Attempts to simultaneously synthesize and fabricate U_3Si_2 by hot-pressing stoichiometric mixtures of U and silicon powders resulted in products consisting of mixtures of U_3Si_2 and other silicides of U. (W.L.H.)

1447 AEC-tr-3847
APPLICATION OF FLOAT METHOD FOR PRECISION MEASUREMENT OF DENSITY OF WATER BETWEEN 3.7 AND 4.2°C AND FOR DENSITY MEASUREMENTS OF VERY SMALL SAMPLES OF SOLID SUBSTANCES. J. Spaepen. Translated for Los Alamos Scientific Lab. from Mededel. Koninkl. Vlaam. Acad. Wetenschap., Belg., Kl. Wetenschap 19, No. 5, 24p. (1957). 20p. JCL.

In connection with a study of enrichment processes of heavy water the float method has been used. The refinements applied to obtain an extremely high accuracy are described in detail. The very high accuracy of the density which was reached (better than $\pm 1.10^{-8}$ g/ml) is illustrated by a series of measurements on the density of water of normal isotopic composition in the region of the maximum density. The results are plotted. The maximum density is situated at 3.99°C. A variant of the method enables density measurements on samples of only a few milligrams of dense materials (metals) with an accuracy of ±2%. (auth)

1448 AEC-tr-3870
DETERMINATION OF THE SATURATED VAPOR PRESSURE OF UCl_4 AND THE DISPROPORTIONATION PRESSURE OF $UOCl_2$. S. A. Schchukariev, I. V. Vasilkova, A. I. Efimov, and V. I. Kirgyasev. Translated for Oak Ridge National Lab. from Zhur. Neorg. Khim. 1, 2272-7(1956). 11p. JCL or LC.

The data in the literature on the saturated vapor pressure of solid UCl_4 were experimentally verified in the temperature interval 358 to 435°C. The disproportionation pressure of $UOCl_2$ was determined in the temperature interval 425 to 542°C. It was shown that under heating the oxychloride of tetravalent uranium disproportionates as follows: $2UOCl_2 \rightleftharpoons (UCl_4)_{gas} + UO_2$. (auth)

1449 AEC-tr-3871
HEATS OF SUBLIMATION OF TETRAFLUORIDES OF URANIUM, NEPTUNIUM, PLUTONIUM AND AMERICIUM. (Teploty Sublimatsii Tetraftoridov Urana, Neptuniya, Plutoniya i Ameritsiya). E. G. Chudinov and D. Ya. Choporov. Translated by Helen J. Chick (Los Alamos Scientific Lab.) from report NP-7516. 3p. JCL or LC.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 14234.

1450 AEC-tr-3873
CONCERNING THE SOLUBILITY OF OXYGEN IN TANTALUM AND THE RELATED PROPERTY CHANGES. Erich Gebhardt and Hans Preisendanz. Translated by L. D. P. King (Los Alamos Scientific Lab.) from Z. Metallk. 46, 560-8(1955). 30p. JCL.

The solubility of oxygen in tantalum at various pressures and temperatures and the effect on internal damping, modulus of elasticity, magnetic susceptibility, hardness, tensile properties, and chemical stability are discussed. (J.E.D.)

1451 AEC-tr-3877
KINETICS OF AMERICIUM(V) REDUCTION BY HYDROGEN PEROXIDE. (Kinetika Vosstanovleniya Ameritsiya(V) Perekis'Yu Vodoroda). A. A. Zaitsev, V. N. Kosyakov,

A. G. Rykov, Yu. P. Sobolev, and G. N. Yakolev. Translated by Helen J. Chick (Los Alamos Scientific Lab.) from report NP-7514. 8p. JCL or LC.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 14233.

1452 AEC-tr-3879

CHEMICAL COMPOUNDS IN FUSIONS OF ALKALI BORATES AND THEIR VOLATILITY. N. V. Solomin and L. V. Potemkina. Translated by Lydia Venters (Argonne National Lab.) from Doklady Akad. Nauk S.S.S.R. 96, 91-3 (1954). 6p. JCL or LC.

The stability of lithium borates, sodium borates, and potassium borates in fusions was determined. (W.L.H.)

1453 AEC-tr-3885

DISPROPORTIONATION OF AMERICIUM(IV). (Disproportsionirovanie Ameritsiya(IV)). A. A. Zaitsev, V. N. Kosyakov, A. G. Rykov, Yu. P. Sobolev, and G. N. Yakolev. Translated by Helen J. Chick (Los Alamos Scientific Lab.) from Report NP-7517. 7p. JCL or LC.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 14235.

1454 CEA-tr-A-581

RÉACTIONS ANORMALES DANS LES ÉCHANGEURS D'IONS. (Anomalous Reactions in Ion Exchangers). R. Griessbach. Translated into French from Chimia (Switz.) 11, No. 2, 29-41(1957). 33p.

Anomalies in the behavior of ion exchangers and their interest to science are discussed. (T.R.H.)

1455 NP-tr-293

THE MODIFICATIONS OF Na_2BeF_4 AND THEIR RELATIONSHIPS TO THOSE OF Ca_2SiO_4. INVESTIGATIONS OF SILICATE-TYPE STRUCTURES III. (Die Modifikationen des Na_2BeF_4 und ihre Beziehungen zu Denen des Ca_2SiO_4. Untersuchungen an Silikatmodellen III). Erich Thilo and Friedrich Liebau. Translated by M. H. Rand (U.K.A.E.A. Atomic Energy Research Establishment) from Z. physik. Chem. (Leipzig) 199A, 125-41(1951). 32p. (includes original, 18p.) JCL.

Five different modifications of Na_2BeF_4 were prepared and identified, and the conditions for their mutual interconversions were established. A comparison with the modifications of Ca_2SiO_4 reveals the extensive structural analogies between the $NaF-BeF_2$, and the $CaO-SiO_2$ systems. (J.R.D.)

1456

THE EXISTENCE OF PYROCHLORE-TYPE COMPOUNDS IN ZIRCONIA–RARE EARTH OXIDE SYSTEMS AND THEIR ORDER-DISORDER TRANSFORMATIONS. Monique Perez y Jorba, Robert Collongues, and Jean Lèfevre. Compt. rend. 249, 1237-9(1959) Oct. 5. (In French)

The principle properties and order-disorder transformations in $La_2Zr_2O_7$, $Ce_2Zr_2O_7$, $Nd_2Zr_2O_7$, $Sm_2Zr_2O_7$, and $Gd_2Zr_2O_7$ are discussed. The existence and stability of pyrochlore compounds in $ZrO_2-A_2O_3$ systems (A = rare earth) are shown to depend essentially on the ionic radius of the trivalent cation. (T.R.H.)

1457

ABOUT CALCULATION OF ADSORPTION ENERGY ON NON-POLAR MOLECULES BY GRAPHITE. N. N. Avgul, A. V. Kiselev, I. A. Lygina, and D. P. Poshkus (Lomonosov Moscow State Univ.). Izvest. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk No. 7, 1196-1206(1959) July. (In Russian)

Additional theoretical calculations were made of the energy of adsorption of simple and complex non-polar molecules in graphite. Exponential sums of Σr_{ij}^{-n} type with n = 6, 8, 10, and 12, and exponential sums of $\Sigma_e^{-rij/p}$ type with p = 0.28A were calculated for the adsorbed molecule at various distances from the external basic place of graphite. Constants of three members of the dispersion expanse energy were calculated using approximate formulas and constants of repulsion were found from the conditions of equilibrium. Potential curves and equilibrium energies of adsorbed complex molecules are estimated on the basis of an additive scheme. (R.V.J.)

1458

ISOTOPIC EXCHANGE BETWEEN FREE OXYGEN AND SEVERAL SILICON COMPOUNDS. V. I. Spitsyn and V. G. Finikov (Inst. of Physical Chemistry, Academy of Sciences, USSR). Izvest. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk No. 7, 1351-2(1959) July. (In Russian)

Isotopic exchange between gaseous oxygen containing 1.3 at. % O^{18} and silicon compounds SiO_2, K_2SiO_3, and $K_2Si_2O_5$ was studied in order to determine oxygen bond stability. The results of the investigation carried out at 750 to 850° are tabulated. Activation energies characterize the bond stability and oxygen lattices of the compounds and are determined with an order of accuracy of ±1 k cal/mol. It is shown that in potassium metasilicate the oxygen bond is weaker than in sulfate, while in binary silicon oxide and potassium metasilicate, the oxygen bond is almost identical. (R.V.J.)

1459

THERMODYNAMICS OF FORMATION OF TANTALUM–HYDROGEN SOLID SOLUTIONS FROM VAPOR PRESSURE DATA. Per Kofstad, W. E. Wallace, and L. J. Hyvönen (Univ. of Pittsburgh). J. Am. Chem. Soc. 81, 5015-19 (1959) Oct. 5.

Vapor pressures of the tantalum-hydrogen system were measured for temperatures ranging from 164 to 402°C and for alloys containing from 0.1 to 33⅓ at. % hydrogen. The data for temperatures between 300 and 400°C were treated to obtain partial molal free energies, entropies and enthalpies, and the free energies, entropies and heats of formation of the solid solutions. The data are in agreement with Sievert's Law only at intermediate concentrations. Positive deviations occur at high concentrations due to a progressive filling of interstitial sites and a reduction in the entropy of the system. Complex behavior is observed in dilute solutions, originating, it is thought, with gaseous impurities (oxygen and nitrogen) in the sample. The partial heat of vaporization is about half as large in dilute solutions as in concentrated solutions and the entropy of dissolved hydrogen is unexpectedly high. The reason for this behavior is not clear. (auth)

1460

VAPOR PRESSURE STUDIES OF THE VANADIUM–HYDROGEN SYSTEM AND THERMODYNAMICS OF FORMATION OF VANADIUM–HYDROGEN SOLID SOLUTIONS. Per Kofstad and W. E. Wallace (Univ. of Pittsburgh). J. Am. Chem. Soc. 81, 5019-22(1959) Oct. 5.

Vapor pressure data for the vanadium–hydrogen system have been obtained for temperatures extending from 165 to 456°C and for compositions from 0.5 to 33 at. % hydrogen. The data were used to evaluate the thermodynamic properties of the system. Since no invariancy of vapor pressure with composition occurs, the results pertain to a single phase, the primary solid solution based on vanadium. Appreciable deviations from Sieverts' Law are observed. The results seem to imply the existence of two types of sites which are being occupied by hydrogen, the regular interstitial sites in the normal lattice and atypical sites, which occur at disturbed regions in the lattice. (auth)

1461

THERMODYNAMICS OF THE SULFATE COMPLEXES OF THORIUM. A. J. Zielen (Argonne National Lab., Lemont, Ill.). J. Am. Chem. Soc. 81, 5022-8(1959) Oct. 5.

By use of the cation-exchange resin technique in perchloric acid solutions at an ionic strength of 2.00 and at 25°C, thorium(IV) was observed to associate with sulfate according to the stepwise reactions: $Th^{+4} + HSO_4^- = ThSO_4^{+2} + H^+$ and $ThSO_4^{+2} + HSO_4^- = Th(SO_4)_2 + H^+$ with the association constants $K_1 = 166 \pm 8$ and $K_2 = 21.7 \pm 1.5$. The heats and entropy changes of the reactions were determined calorimetrically with the results: ΔH_1 and ΔH_2 equal -0.54 ± 0.05 and -0.89 ± 0.08 kcal./mole, respectively and ΔS_1 and ΔS_2 equal 8.4 ± 0.2 and 3.2 ± 0.3 cal. deg.$^{-1}$ mole^{-1}, respectively. The heat of ionization of bisulfate ion at an ionic strength of 2.00 and at 25°C was also measured calorimetrically with the result ΔH equals -5.54 ± 0.17 kcal./mole. (auth)

1462

MAGNESIUM—CADMIUM ALLOYS. X. HEAT CAPACITY OF MgCd BETWEEN 20 AND 270° AND A FINAL EVALUATION OF THE RESIDUAL ENTROPY OF THE MgCd SUPERLATTICE. K. F. Sterrett, W. G. Saba, and R. S. Craig (Univ. of Pittsburgh). J. Am. Chem. Soc. 81, 5278-80(1959) Oct. 20.

The heat capacity of MgCd was measured at 25 to 270°C by adiabatic calorimetric techniques permitting a precision of 0.1 to 0.2% in the measurements. The data show a sharp first degree transition at about 251°C superimposed upon a broad second degree order-disorder transition of the type customary for such alloys. With the aid of the heat capacity data, the residual entropy of MgCd has been calculated to be 0.035 ± 0.04 e.u./g atom. Standard heats, free energies and entropies of formation of the alloy at 270°C, which were reported earlier, have been corrected to 25°C. Transition energy and temperature agree well with values reported by other investigators. (auth)

1463

THE REACTION OF BROMINE TRIFLUORIDE AND FLUORINE TO FORM BROMINE PENTAFLUORIDE. Harris E. Kluksdahl and George H. Cady (Univ. of Washington, Seattle). J. Am. Chem. Soc. 81, 5285-7(1959) Oct. 20.

The kinetics of the gas phase reaction of bromine trifluoride and fluorine to form bromine pentafluoride were studied at 68 to 121°C in a nickel reactor and with the initial pressures at 30 to 300 mm. The reaction is bimolecular, homogeneous and has an activation energy of 16.4 kcal. The observed frequency factor 2.6×10^{11} cc mole^{-1} sec^{-1}, corresponds to a probability factor of 10^{-3}, thus indicating that only a part of the bimolecular collisions of sufficient energy to cause reaction actually results in the formation of bromine pentafluoride. (auth)

1464

ADSORPTION ON MICROPOROUS BARRIERS. Lenard O. Rutz, John B. Graham, and Karl Kammermeyer (State Univ. of Iowa, Iowa City). J. Chem. Eng. Data 4, 307-10 (1959) Oct.

Data are given on adsorption isotherms for hydrogen, nitrogen, and argon at 0, 25, and 40°C over a pressure range of 0.8 to 9.3 atm. absolute. Vapor adsorption data were obtained for carbon dioxide, the alkanes methane, propane, and n—butane, and the alkenes ethene, propene, and 1-butene at 0, 25, and 40°C over a pressure range of 1.5 to 9.3 atm. absolute. The solid adsorbant used was Vycor porous glass. (C.J.G.)

1465

EUROPIUM AND SAMARIUM REDUCTION. T. T. Campbell and F. E. Block (Bureau of Mines Experiment Station, Albany, Ore.). J. Metals 11, 744-6(1959) Nov.

High-purity europium and samarium metals were prepared by lanthanum and zirconium reduction of the oxides. High-purity europium was obtained with reduction temperatures as low as 900°C. Samarium metal was prepared in good yield by zirconium reduction of Sm_2O_3. Both cerium and aluminum reduced the samarium and europium oxides but were found to exert appreciable vapor pressure at operating temperatures and as a result tend to volatilize along with the samarium or europium metals. (C.J.G.)

1466

ON COAGULATION EFFECTS OF HIGHLY CHARGED COUNTERIONS. E. Matijević, D. Broadhurst, and M. Kerker (Clarkson Coll. of Tech., Potsdam, N. Y.). J. Phys. Chem. 63, 1552-7(1959) Oct.

Sols whose charge had been reversed by 9-tungstophosphoric acid were coagulated by simple mono-, di-, tri- and tetravalent cations. These sols, which were originally positively charged, behaved as normal negative sols to the above coagulating cations. The influence upon the coagulation concentration of a number of procedures for preparing the recharged sols was investigated. The coagulation concentration of a hexol for negative silver halide sols has been determined at several pH values. At low pH, the hexol exhibits a coagulation concentration consistent with ionization to a hexavalent species. Just as had been found previously for highly charged anions, the highly charged hexol cation causes reversal of charge on the colloidal particles. The availability of critical coagulation concentrations of highly charged ions has made possible a detailed comparison of coagulation data with the requirements of existing quantitative expressions for the Schulze-Hardy rule. The validity of the theories of Derjaguin-Landau-Verwey-Overbeek, of Whetham and of Težak in relation to these coagulation data has been discussed. (auth)

1467

THE VARIATION OF LATTICE PARAMETER WITH CARBON CONTENT OF NIOBIUM CARBIDE. E. K. Storms and N. H. Krikorian (Los Alamos Scientific Lab., N. Mex.). J. Phys. Chem. 63, 1747-9(1959) Oct.

A lattice constant of $a_0 = 4.4702 \pm 0.0001$ A was determined for $NbC._{0.994 \pm 0.002}$ at 25°. The equation $a_0 = 4.4704 - 0.0239\,(1 - C/Nb) - 0.3586\,(1 - C/Nb)$ was calculated relating composition to lattice parameter of NbC. Solution of this equation for $NbC_{1.000}$ gives a lattice-parameter of 4.4704 ± 0.0005 A. (auth)

1468

PHASE EQUILIBRIA IN THE BINARY SYSTEMS $PuCl_3$—NaCl AND $PuCl_3$—LiCl. C. W. Bjorklund, J. G. Reavis, J. A. Leary, and K. A. Walsh (Los Alamos Scientific Lab., N. Mex.). J. Phys. Chem. 63, 1774-7(1959) Oct.

Equilibrium diagrams for the binary systems $PuCl_3$—LiCl and $PuCl_3$—NaCl were studied over the temperature range 100 to 825° by thermal and differential thermal analysis techniques. A single eutetic was observed in each system with no evidence of solid solution or compound formation. The eutectic occurred at 461°C and 28 mole % $PuCl_3$ in the $PuCl_3$—LiCl system and at 453°C and 36 mole % $PuCl_3$ in the $PuCl_3$—NaCl system. The melting points of LiCl, NaCl and $PuCl_3$ in equilibrium with an atmosphere of anhydrous HCl were 607 ± 2°, 802 ± 2° and 767 ± 2°C, respectively. Within experimental error, the same values were obtained for the melting points of these salts under vacuum. (auth)

1469

THE HEAT OF CHLORINATION OF DIBORON TETRA-

CHLORIDE. S. R. Gunn, L. G. Green, and A. I. Von Egidy (Univ. of California, Livermore). J. Phys. Chem. 63, 1787-8(1959) Oct.

Measurement of the heat of chlorination of B_2Cl_4 is described in which chlorine was passed slowly into the reaction vessel containing liquid or gaseous B_2Cl_4. The heat of formation of B_2Cl_4(l) is −126.2 and that of B_2Cl_4(g) is −118.2°C. (J.R.D.)

1470

NEUTRON DIFFRACTION STUDY OF ANTIFERROMAGNETIC $MnTiO_3$ AND $NiTiO_3$. Gen Shirane (Westinghouse Research Lab., Pittsburgh); S. J. Pickart (Naval Ordnance Lab., White Oak, Md. and Brookhaven National Lab., Upton, N. Y.); and Yoshikazu Ishikawa (Univ. of Tokyo). J. Phys. Soc. Japan 14, 1352-60(1959) Oct.

$MnTiO_3$ and $NiTiO_3$ have a rhombohedral crystal structure similar to $FeTiO_3$ in which layers of Fe and Ti atoms alternate along the rhombohedral axis with oxygen layers between them. A powder neutron diffraction study shows that $MnTiO_3$ has a magnetic structure with the Mn^{2+} spins antiparallel within each layer. On the other hand, $NiTiO_3$ has the same magnetic structure as $FeTiO_3$, in which the spins are parallel within each layer and adjacent layers are antiparallel. The spins are directed along the [1 1 1] direction in $MnTiO_3$ and perpendicular to it in $NiTiO_3$. In addition to the magnetic study, the nuclear intensities indicate that the Ni and Ti in $NiTiO_3$ are only 88% ordered. (auth)

1471

EUROPIUM HEXABORIDE. G. V. Samsonov, V. P. Dzeganovskii, and I. A. Semashko. Kristallografiya 4, No. 1, 119-20(1959).

EuB_6 has hitherto been unexamined. It was synthesized by the reaction $Eu_2O_3 + 3B_4C = 2EuB_6 + 3CO$ in vacuo at 1,650°C over the course of two hours. X ray powder photographs were taken of the product which contained less than 0.02% C and was dark grey. The unit cell is cubic with a = 4.163 ± 0.001 kX and space group O_h', characteristic of all the hexaborides of the rare earths. The x ray density is 4.99 ± 0.01 g/cm^3. The atomic radii of Eu and Yb are greater than those of the other rare earths and their unit cells are correspondingly greater (about 4.14). The work function of EuB_6 (for an emission constant of A = 1,000−5,000 A/cm^2) was found to be 4.90 ev which is higher than that of any other rare-earth hexaboride. It indicates the maximum multiplicity and consequently the greatest binding of the electrons of Eu which has in the normal state 7 electrons in the 4f-shell, without the presence of electrons in the 5d-shell; such a 5d-electron in Gd causes a sharp fall in the work function of its hexaboride by comparison with EuB_6 (φ_{GdB_6} = 2.06 ev). (TCO)

1472

AN ELECTRONOGRAPHIC INVESTIGATION OF THE STRUCTURE OF MOLECULES OF THE HALIDES OF GALLIUM AND YTTRIUM. P. A. Akishin, V. A. Naumov, and V. M. Tatevskii. Kristallografiya 4, No. 2, 194-200 (1959).

Investigations were made using the sector-photometric method and the new electronograph. The results were analyzed by successive approximations and the method of radial distributions. Theoretical and experimental distribution curves are reproduced. Ga_2Cl_6 and Ga_2Br_6 were dimeric with Ga-Ga distances of 3.28 and 3.41 Å, respectively, and angles X_3-Ga_2-X_4 of 112° ± 3 and 110° ± 3 and Ga_1-X_5-Ga_2 of 91° ± 3 and 93° ± 3. All other distances are tabulated. The other compounds GaF_3, GaI_3, YF_3, YCl_3, YBr_3, and YI_3 were plane triangular molecules with Me-X distances of 1.88, 2.44, 2.04, 2.47, 2.63, 2.80 ± 0.03 A, respectively. These observations contradict some by Brode (Ref 3). Ga_2F_6 molecules were present (as shown by mass spectrometry) to an extent of < 1% and Ga_2I_6 molecules were present to about 8% in GaI_3 at the m.p. (TCO)

1473

AUTORADIOGRAPHY OF TRITIUM-LABELLED COMPOUNDS ON PAPER CHROMATOGRAMS. A. W. Rogers (Univ. of Birmingham, Eng.). Nature 184, Suppl. No. 10, 721(1959) Aug. 29.

Chromatograms of titrated progesterone of known activity were prepared on Whatman No. 1 paper treated with the Bush A solvent system. After drying, the strips were taken into a dark-room and passed through a trough of melted photographic emulsion at 50°C. Ilford K2 emulsion diluted by an equal volume of distilled water was used. The strips were hung at room temperature for 2 hours to dry and then placed in a light-proof box with about 20 gm of dried silica gel and left in a cold room at 5°C for periods ranging from one to four weeks. They were then processed in tanks of standard x-ray developer for 5 to 6 min, 10 to 15 min in fixer, washed for 2 hr in running water, and dried. The technique is reported to be very sensitive and applicable to the study of tritium-labeled compounds. (C.H.)

1474

A METHOD FOR THE PREPARATION OF CYCLOTRON TARGETS OF RARE-EARTH OXIDES BY ELECTROPHORESIS. S. Bjørnholm, PH. Dam, H. Nordby, and N. O. Roy Poulsen (Univ. of Copenhagen). Nuclear Inst. and Methods 5, 196-8(1959) Sept.

The preparation of cyclotron targets of the rare earth oxides is presented. The oxides in the form of a fine powder are brought to adhere on a gold plate by an electrophoresis method which is essentially the same used in the production of oxide cathodes. (C.J.G.)

1475

THE DIFFUSION OF TRITIUM IN LIQUID ARGON. G. Cini-Castagnoli (Università, Rome and Istituto Nazionale di Fisica Nucleare, Rome) and A. Giardini and F. P. Ricci (Comitato Nazionale Ricerche Nucleari, Rome). Nuovo cimento (10) 13, 916-20(1959) Sept. 1.

A simple expression of the diffusion coefficient as a function of temperature at constant pressure for mixtures of perfect liquids was investigated for HT in liquid argon. The value obtained by the capillary method adopted for low temperature work is D_{exp}(HT-A) = (3.17 ± 0.15)10^{-5} cm^2/s at T = 84.5°K in satisfactory agreement with the calculated value D_{calc} (HT-A) = 2.94 10^{-5}cm^2/s. (auth)

1476

ISOTOPE EFFECT IN VACANCY DIFFUSION. K. Tharmalingam and A. B. Lidiard (Univ. of Reading, Berks. Eng.). Phil. Mag. (8) 4, 899-906(1959) Aug.

The experimental determination of correlation factors in diffusion in crystals is of great value in elucidating diffusion mechanisms. Schoen (1958) recently proposed a method applicable to both metals and non-metals based on measurements of the relative diffusion rates of two different isotopes of the diffusing element. His analysis was based on an equation derived from an approximate expression for the correlation factor for vacancy diffusion. It is shown that his basic equation is exact for all systems having at least two-fold rotational symmetry about the vacancy-solute jump directions. (auth)

1477

SOME ASPECTS OF THE POLAROGRAPHIC BEHAVIOUR OF TECHNETIUM AND RHENIUM. R. J. Magee, I. A. P.

Scott, and C. L. Wilson (Queen's Univ., Belfast). Talanta 2, 376-9(1959) Aug.

The oxidation-reduction behavior of technetium was investigated polarographically by means of ultramicro methods. Rhenium was examined as a control and a guide. The behavior of technetium was found to be similar to that of rhenium more than to that of manganese. (C.J.G.)

1478

EQUILIBRIUM STUDY OF THE HIGH TEMPERATURE REDUCTION OF HAFNIUM DIOXIDE (HfO_2) BY CARBON. V. I. Zhelankin, V. S. Kutsev, and B. F. Ormont (L. Ya. Karpov Inst. of Physical Chemistry and All-Union Scientific Investigation Inst. of Solid Alloys). Zhur. Fiz. Khim. 33, 1988-91(1959) Sept. (In Russian).

An equilibrium study of the reduction of HfO_2 by carbon was made over the range of temperatures 1743 to 2003°K and pressures 70 to 1000 mm Hg by a manometric method. The phases participating in the equilibrium are: HfO_2—monoclinic lattice, carbide—face-centered cubic lattice, graphite and CO. The equilibrium CO pressure has been determined for the corresponding temperatures. The dependence of lg P on 1/T and the constant period of the carbide lattice $a = 4.626_6$ kx and $a = 4.627_2$ kx at 1743 and 2003°K respectively show that the equilibrium composition of the carbide may be considered practically constant in the region of T and p investigated. Under such conditions the equilibrium is monovariant and in its general form expressed by the equation: $Q_p = -132 \pm 3$ kcal $(-T = 1743 - 2003°K)$. The heat effect of HfO_2 reduction is $HfO_2 + (x - y + 2)\ C \rightleftharpoons HfC_xO_y) + (2 - y)\ CO + Q_p$. (auth)

1479

STUDIES OF HEXABORIDES OF RARE EARTHS AND YTTRIUM. N. N. Tvorogov (Inst. of Radiotechnics and Electronics, Academy of Sciences, USSR). Zhur. Neorg. Khim. 4, 1961-6(1959) Sept. (In Russian)

X-ray studies were made of prepared hexaborides of Ce, Er, Eu, Gd, Ho, La, Nd, Pr, Sm, Tb, Tm, Y, and Yb, and their densities were determined. Boron compounds with Tb and Tm were synthesized, and lattice parameters for Gd, Ho, and Tb tetraborides were estimated. (R.V.J.)

1480

ELECTROLYTIC REDUCTION OF SAMARIUM. D. I. Ryabchikov, Yu. S. Sklyarenko, and N. S. Stroganova. Zhur. Neorg. Khim. 4, 1985-9(1959) Sept. (In Russian)

Chemical processes taking place in the solution during samarium acetate electrolysis with a mercury cathode are analyzed. The effects of the initial pH of the solution and the temperature on the yield of samarium are investigated. (R.V.J.)

1481

ABSORPTION SPECTRA OF URANYL NITRATE IN ORGANIC SOLVENTS. S. I. Sinyakova and N. S. Klassova. Zhur. Neorg. Khim. 4, 2000-8(1959) Sept. (In Russian)

Optical densities of $UO_2(NO_3)_2$ in aqueous HCl (pH 1 to 2) saturated with NH_4NO_3, 4% orthophosphoric acid, and 10% H_2SO_4 were measured at various wave lengths in order to compare uranyl nitrate absorption spectra in organic solvents with its absorption spectra in aqueous solutions. (R.V.J.)

1482

INTERACTIONS IN THE $Th(NO_3)_4-NaF-H_2O$ SYSTEM. I. V. Tananaev and Lu Chao-ta. Zhur. Neorg. Khim. 4, 2116-21(1959) Sept. (In Russian)

Physicochemical analysis of the $Th(NO_3)_4-NaF-H_2O$ system uncovered a binary salt of $NaThF_5 \cdot H_2O$ composition which formed in the system in addition to thorium fluoride. Data on the x-ray and thermal analysis of the salt are included. (R.V.J.)

1483

THORIUM FLUORIDE COMPLEX FORMATION REACTIONS IN SOLUTION. I. V. Tananaev and Lu Chao-ta. Zhur. Neorg. Khim. 4, 2122-6(1959) Sept.

The composition and stability of thorium fluoride ions in solutions were determined by solubility and optical methods. The solubility of CaF_2 in $Th(NO_3)_4$ solutions and in $Th(NO_3)_4$ + NaF mixtures was investigated. It was found that ThF^{3+} and ThF^{2+} ions are formed in the solution. $K_{ThF^{3+}} = 1.2 \times 10^{-6}$ (solubility method) and 1.3×10^{-6} (optical method); $K_{ThF_2^{2+}} = 1.8 \times 10^{-3}$ (solubility method). (R.V.J.)

1484

INVESTIGATION OF URANYL COMPLEX FORMATION IN OXALATE SOLUTION BY THE SOLUBILITY METHOD. A. I. Moskvin and F. A. Zakhorova. Zhur. Neorg. Khim. 4, 2151-60(1959) Sept. (In Russian)

Processes of uranyl complex formation with oxalate ions take place with hydrogen ion concentrations of <2 mole/l. The solubility of $UO_2(C_2O_4) \cdot 3\ H_2O$ is equal to 2.2×10^{-3} in chloric acid solutions and 3.0×10^{-3} in nitric acid solutions Complexes of $UO_2(C_2O_4)$ and $UO_2(C_2O_4)_2^{2-}$ with concentration instability constants equal to $K_n^2 = (1.7 \pm 0.3) \times 10^{-7}$ and $K_n^3 = (1.0 \pm 0.3) \times 10^{-12}$ and acetolysis constants equal to 2.5×10^{-2} and 2.1×10^{-2}, respectively, were found. (R.V.J.)

1485

A SIMPLE METHOD FOR PREPARATION OF GASEOUS BF_3. I. V. Andreev (Inst. of High Molecular Compounds, Academy of Sciences, USSR). Zhur. Priklad. Khim. 32, 1855-7(1959) Aug. (In Russian).

The preparation of pure BF_3 from boron fluoride phenyldiazon is described. (R.V.J.)

1486

CRYSTAL CHEMISTRY OF SIMPLE COMPOUNDS OF URANIUM, THORIUM, PLUTONIUM, AND NEPTUNIUM. E. S. Makarov. Translated from Russian by E. B. Uvarov. New York, Consultants Bureau, Inc., 1959. 148p.

This paper was previously abstracted from the original language and appears in NSA, Volume 13, as abstract No. 4551.

1487

REDKOZEMEL'NYYE ELEMENTY; POLUCHENIYE, ANALIZ, PRIMENENIYE. (Rare Earth Elements; Production, Analysis, and Use). D. I. Ryabchikov, ed. Moscow, Izd-vo AN SSSR, 1959. 331p.

Articles comprising reports given at the Rare Earth Elements Symposium held in June 1956 at the Institute of Geochemistry and Analytical Chemistry imeni V. I. Vernadskiy are presented. The book is divided into sections covering the characteristics, uses and production of rare earth elements (REE), the methods of analyzing REE, and the application of individual rare earth elements and REE mixtures in the glass and metallurgical industries. Considerable space is devoted to the application of ion-exchange chromatography in the production of pure forms of all rare earth elements. The combinations of this method with other methods in separating REE on an industrial scale are discussed. Chemical methods of separating and analyzing REE compounds are discussed, and quantitative x ray spectral analytical methods are described. The determinations of REE impurities in pure products and atomic materials are discussed at length. All articles are accompanied by photographs, diagrams, tables, and bibliographic references. (auth)

1488
PROCESS FOR OBTAINING URANIUM TETRAFLUORIDE MORE ESPECIALLY IN A NUCLEAR-PURE FORM. (to Deutsche Gold-und Silber-Scheidenstalt vormals Roessler). British Patent 821,957. Oct. 14, 1959.

A process for producing UF_4 from pure $UO_2C_2O_4$ is described. The $UO_2C_2O_4$ is precipitated from $UO_2(NO_3)_2$ solution using solid $H_2C_2O_4$ and recrystallized. The oxalate is decomposed to UO_2 in a rotary tube furnace with CO_2 at 600°C. In a similar furnace the UO_2 reacts with HF at 140°C to produce UF_4. The process can be carried out in one stage batch-wise. (T.R.H.)

1489
EXTRACTION OF THORIUM FROM AQUEOUS SOLUTION. Arnold Audsley and Walter Ryan (to United Kingdom Atomic Energy Authority). British Patent 821,973. Oct. 14, 1959.

A method of extracting Th from Fe-containing aqueous solutions is described. The Th is extracted into an amine phase such as 2-amino-2:4:4-trimethylpentane with kerosene diluent. The Th can then be separated into an HNO_3 solution. (T.R.H.)

1490
IMPROVEMENTS IN OR RELATING TO PROCESSES FOR THE PREPARATION OF DEUTERIUM-CONTAINING CARBON. (to N. V. De Bataafsche Petroleum Maatschappij). British Patent 823,198. Nov. 4, 1959.

A process for preparing D-containing carbon for reactor structures is described which involves exchanging D for H adsorbed on finely divided carbon at high temperatures. More specifically, carbon powder (10-20 mesh ASTM) was degassed at 650°C and 0.01 mm Hg. The degassed C with a H_2 content of 2.4 wt. % was exposed to D_2 (98.4 vol. % D, 1.6 vol. % HD) at 575°C so that 88% of the H was replaced by D. (T.R.H.)

Analytical Procedures

1491 AECU-4417
Nuclear-Chicago Corp., Chicago.
EXPLORATION OF RADIOMETRIC METHODS. Report No. 2. William J. Driscoll and Edmund A. Huff. Sept. 30, 1959. 24p. Contract AT(11-1)-695. OTS.

A number of ions were determined by radiometric analysis technique. Included were determinations such as Cl^- as AgCl, CN^- as AgCN, $CrO_4^=$ as Ag_2CrO_4, and I^- as AgI using Ag^{110} in all cases. Cl^- was determined as Hg_2Cl_2 using Hg^{203}, Ba^{++} and $SO_4^=$ as $BaSO_4$ using $S^{35}O_4$; Pb^{++} as $PbSO_4$ using $S^{35}O_4$; and F^- as CaF_2 using Ca^{45}. Techniques and calculation methods are outlined. (J.R.D.)

1492 AERE-AM-51
United Kingdom Atomic Energy Authority. Research Group. Chemistry Div., Woolwich Outstation, England.
THE DETERMINATION OF RADIOACTIVITY IN WATER. R. G. Osmond and A. G. Pratchett. July 1959. 20p. BIS.

The sample for analysis, after addition of carriers, is evaporated to dryness and treated with perchloric acid and hydrochloric acid to remove silica. The residue is taken into solution by extraction with hydrochloric acid and fusion with sodium carbonate, and the various radioactive constituents are separated and purified by standard radiochemical procedures. (auth)

1493 BM-RI-5526
Bureau of Mines.
X-RAY EMISSION SPECTROGRAPHIC ANALYSIS OF HIGH-PURITY RARE-EARTH OXIDES. Farrel W. Lytle and Howard H. Heady. Apr. 1958. 11p.

This investigation was conducted to determine the precision and accuracy of x-ray fluorescence in the determination of impurities in rare-earth oxides in the 0.01 to 1.0% concentration range. (auth)

1494 IEA-3
São Paulo. Brazil. Universidade. Instituto de Energia Atômica and São Paulo, Brazil. Universidade. Escola Politécnica.
STATISTICAL ANALYSIS OF SPECTROPHOTOMETRIC DETERMINATIONS OF BORON. (Estudo Estatistico de Determinacôes Espectrofotométricas de Boro). Fausto W. Lima, Constancia Pagano, and Boris Schneiderman. July 1959. 16p.

Boron can be determined quantitatively by absorption spectrophotometry of solutions of the red compound formed by the reaction of boric acid with curcumin. This reaction is affected by various factors, some of which can be detected easily in the data interpretation. Others, however, provide more difficulty. The application of modern statistical method to the study of the influence of these factors on the quantitative determination of boron is presented. These methods provide objective ways of establishing significant effects of the factors involved. (auth)

1495 IGO-R-/CA/56
United Kingdom Atomic Energy Authority. Industrial Group. Capenhurst Works, Capenhurst, Ches., England.
THE DETERMINATION OF THE ISOTOPIC ABUNDANCE OF URANIUM BY MEANS OF HIGH-RESOLUTION SPECTROSCOPY. I. THE CONSTRUCTION AND OPERATION OF A SPECTROGRAPH EMPLOYING AN ECHELLE GRATING AND PHOTOGRAPHIC RECORDING. R. P. Thorne. July 1957. 15p. (IGC/ARDC/P-289; IGC/CTC/P-151).

A simple, compact, high resolution spectrograph has been constructed which employs an echelle grating in a Littrow mounting. The dispersion and resolving power of the instrument are sufficient to separate the isotopic lines of U^{235} and U^{238} at 4244A, and these lines have been used to determine the abundance of U^{235} in a standard sample using a photographic recording technique. The conventional technique for determining the intensities of the recorded lines gave erroneous results which were shown to arise as a result of the presence of magnetic hyperfine structure in the U^{235} line and its absence in the U^{238} line. A modified technique was introduced, and a result of 45.63 ± 0.1% U^{235} was obtained which was in close agreement with the accepted value of 45.67% U^{235} for the standard samples. (auth)

1496 IGO-R/CA-57
United Kingdom Atomic Energy Authority. Industrial Group. Capenhurst Works, Capenhurst, Ches., England.
THE DETERMINATION OF THE ISOTOPIC ABUNDANCE OF URANIUM BY MEANS OF HIGH-RESOLUTION SPECTROSCOPY. II. THE USE OF A PHOTO-ELECTRIC 'FIXED SLIT' RECORDING SYSTEM ON AN ECHELLE GRATING SPECTROGRAPH. R. P. Thorne. July 1957. 16p. (IGC/ARDC/P-290; IGC/CTC/P-152).

A "fixed slit" photo-electric recording head has been designed and constructed for the direct recording of uranium isotopic ratios on the echelle grating spectrograph described in the first part of this report. This head has performed very satisfactorily. Accuracies of ±0.2% have been obtained in the determination of U^{235} over the range 4 to 80%, and little maintenance has been required during six months of routine use. Means of further improving the performance of the instrument are indicated. (auth)

1497 JEN-4
Spain. Junta de Energia Nuclear, Madrid.
DETERMINACION ESPECTROFOTOMÉTRICA DE CROMO

(III) CON LA SAL DISODICA DEL ACIDO ETILÉNDIÁMINO-TETRA-ACÉTICO (COMPLEXONA III). (Spectrophotometric Determination of Chromium(III) with the Disodium Salt of (Ethylenediamine)tetraacetic Acid (Complexon III)). R. Fernandez Cellini and E. Alonso Valiente. 1956. 10p.

A spectrophotometric method for Cr (III) determination is established; hot and weak acid solutions are treated by disodium (ethylenediamine)tetraacetic acid (complexone-III) yielding a very stable violet chelate, which follows Beer's law between 1 and 7 γ Cr(III)/ml. These concentrations are employed in the experiences of this work. The absorption spectrum of Cr(III)-complexone-III has two maximums at 396 and 538 mμ. The maximum at 538 mμ is utilized in this method. Time, temperature, pH, and complexone-III concentration are studied and the best experimental conditions are fixed. (auth)

1498 JEN-5
Spain. Junta de Energia Nuclear, Madrid.
DETERMINACION COLORIMETRICA DE BORO CON ALIZARINSULFONATO SODICO. (Colorimetric Determination of Boron with Sodium Alizarin Sulfonate). R. Fernandez Cellini and F. Alvarez Gonzalez. 1956. 17p.

A critical survey of the colorimetric methods commonly accepted and an experimental review of the quinalizarine method were performed. The reagent sodium alyzarinsulfonate was tested for the determination of very small amounts of boron. It has patent advantages over other reagents proposed. The boric acid was extracted by distillation in a closed run as methylboric ester. The wavelength of maximal sensibility 5600 A was deduced from the absorption spectra of the sodium alyzarinsulfonate and the boric acid-sodium alyzarinsulfonate complex. The sensibility of the reagent is about 1.10^{-8} g/cm^3. Many tests and measurements in different ores and reagents show that the lowest limit is 0.1 ppm. (auth)

1499 JEN-7
Spain. Junta de Energia Nuclear, Madrid.
DETERMINACION ESPECTROFOTOMETRICA DE TRAZAS DE TITANO EN NITRATO DE URANILO. (Spectrophotometric Determination of Titanium Traces in Uranyl Nitrate). R. Fernandez Cellini and T. Batuecas Rodriguez. 1956. 12p.

The determination of tracers of titanium in uranyl nitrate is studied. The colorimetric method with H_2O_2 showed little sensitivity in the extreme conditions desired. The colorimetry with thymol was tested. The absorption spectra of the titanium–thymol complex and of the blank of the reagents were determined. The work range was found to be between 4000 and 4500 A, with an absorption maximum at 4400 A. The complex follows Beer's law within a wide concentration range. The range between 0 and 60 γ of titanium in 10 ml was selected. Assays made on samples of titanium-free uranyl nitrate gave consistent results with admissible error limits, when known amounts of titanium were added. Interferences from vanadium and tungsten were studied. (auth)

1500 JEN-8
Spain. Junta de Energia Nuclear, Madrid.
DETERMINACION POTENCIOMETRICA DE URANIO EN ATMOSFERA INERTE CON SULFATO FERRICO. (Potentiometric Determination of Uranium in Inert Atmosphere with Ferric Sulfate). F. Fernandez Cellini and J. Alonso Lopez. 1956. 8p.

Potentiometric titration of uranium with $Fe_2(SO_4)_3$, using Cd as reducing agent was studied. The acidity and sensitivity of this reaction were determined. This method yields good results for the uranite group, if phosphate is first removed by ion exchange with Amberlite IR-120. (auth)

1501 JEN-9
Spain. Junta de Energia Nuclear, Madrid.
CONSIDERACIONES SOBRE EL CONTROL ANALÍTICO DE TRAZAS DE AZUFRE (SULFURO) EN URANIO METAL. (Considerations on the Analytical Control of Sulfur Traces in Uranium Metal). R. Fernandez Cellini and L. Gasco Sanchez. 1956. 10p.

Volumetric and colorimetric determinations of sulfur in uranium were carried out by acid treatment and evaluation of SH_2. According to the experimental results a discussion of both methods was made. (auth)

1502 JEN-47
Spain. Junta de Energia Nuclear, Madrid.
DETERMINACIÓN ESPECTROGRÁFICA CUANTITATIVA DE CIRCONIO EN MINERALES. (Quantitative Spectrographic Analysis of Zirconium in Minerals). M. Roca Adell, F. Alvarez Gonzalez, and R. Fernandez Cellini. 1958. 12p.

A method is described which permits the quantitative determination of zirconium in minerals and rocks at a zirconium concentration of 0.02 to 100% ZrO_2. The excitation is made with a 10 amp direct current arc between carbon electrodes. The sample is placed in a 2-mm deep crater. For low concentration the sample is diluted with its own weight in carbon powder and 4% its weight in Co_3O_4 (internal standard). The lines used are the Zr 2571.4, Co 2585.3, and Co 2587.2 A lines. For high concentrations the sample is diluted with GeO_2 (spectroscopic buffer), carbon powder, and CuO (diluent and internal standard). The Zr 2571.4 and Cu 2768.9 A lines are used. Excellent results are obtained. The mean relative deviation with respect to chemical results is 7.7%. (tr-auth)

1503 KAPL-M-JRC-1
Knolls Atomic Power Lab., Schenectady, N. Y.
THE DETERMINATION OF ALUMINUM, IRON, AND SILICON IN SILVER–CADMIUM–INDIUM ALLOYS. J. R. Ciaranello. Aug. 24, 1959. 10p. Contract W-31-109-Eng-52. OTS.

Aluminum, iron, and silicon were determined by standard procedures with the modifications required by the nature of the matrix material. Aluminum and iron were determined colorimetrically with 8-quinolinol and orthophenanthrolene, respectively, after appropriate separations. Silicon was determined gravimetrically. The methods have been tested on synthetic samples of known composition and found to give acceptable results. (auth)

1504 PA-TN-30
Picatinny Arsenal. Feltman Research and Engineering Labs., Dover, N. J.
INFRARED METHOD FOR DETERMINING SMALL AMOUNTS OF DIPENTAERYTHRITOL HEXANITRATE IN PETN. Walter E. Fredericks and Frank Pristera. Apr. 1959. 5p. DA Project 5A04-10-006.

A simple and rapid method using infrared spectrophotometry was developed for the determination of small amounts of dipentaerythritol hexanitrate (DPEHN) in pentaerythritol tetranitrate (PETN). The method involved preparing a 15% solution of the sample in methyl cyanide; measuring the absorbance of this solution at the peak of the 8.9-micron band using a 1.0 mm rock salt cell; and instrumental compensation of the cell, solvent, and PETN. The net absorbance was converted to percent DPEHN by the use of a previously established relationship between absorbance and concentration. This relationship had been established with standards. The developed method is applicable to the determination of as low as a few tenths of one percent as well as higher percentages of DPEHN in PETN with a precision of about 0.1%. (auth)

1505 TT-827

AMPEROMETRIC TITRATION OF THE PHOSPHATE ION. (Amperometricheskoe Titrovanie Fosfat-iona). V. F. Toropova and G. S. Iakovleva. Translated by D. A. Sinclair (National Research Council of Canada) from Zhur. Anal. Khim. 1, 290-4(1946). 11p. NRC or JCL.

Methods were developed for the amperometric determination of water-soluble phosphoric acid in superphosphates. It was found that in certain cases insoluble phosphate precipitates ($MgNH_4PO_4$, $CaHPO_4$) may be directly back-titrated amperometrically by a solution of lead acetate. The possibility of amperometric titration of phosphates by salts of trivalent iron in a pH range of 3 to 4 was demonstrated in principle. (auth)

1506 TT-836

THE COLORIMETRIC DETERMINATION OF SMALL QUANTITIES OF ALUMINUM IN CHROMIUM–NICKEL AND MAGNESIUM ALLOYS. (Kolorimetricheskoe Opredelenie Malykh Kolichestv Aluminiia v Kromonikelevykh i Magnievykh Splavakh). V. I. Kuznetsov and R. B. Golubtsova. Translated by D. A. Sinclair (National Research Council of Canada) From Zavodskaya Lab. 22, 161-2(1956). 8p.

A method of colorimetric determination of aluminum with the arsenazo reagent in high-percentage alloys and magnesium alloys is described. In alloys containing titanium, zirconium, niobium, and tungsten, after removal of chromium and nickel and after reducing the iron concentration by electrolysis on the mercury cathode, the iron, titanium, and zirconium residues are precipitated with cupferron. After destruction of the cupferron residue in the filtrate and preparation of the solution, colorimetry is carried out. The method permits the determination of as little as 0.001% aluminum in alloys. (auth)

1507 TT-837

METHODS OF DETERMINING IMPURITIES IN ZIRCONIUM. (Metody Opredeleniia Primesei v Tsirkonii). Yu. (Iu.) A. Chernikhov (Chernikov) and B. M. Dobkina. Translated by D. A. Sinclair (National Research Council of Canada) from Zavodskaya Lab. 22, 1019-24(1956). 18p. NRC or JCL.

Methods for the colorimetric determination of cadmium, silver, cobalt, molybdenum, nickel, copper, vanadium, tungsten, iron, chlorine, manganese, and titanium as impurities in zirconium are described. (J.E.D.)

1508

FLAVIANIC ACID AS A NEW SPECIFIC REAGENT FOR ZIRCONIUM. T. Născutiu and Gh. Baiulescu. Acad. rep. populare Romîne, Studii cercetări chim. 6, No. 1, 31-5 (1958). (Translated from Referat. Zhur. Khim. No. 2, 1958, Abstract No. 4318).

It was found that flavianic acid (1-hydroxy-2, 4-dinitro-7-naphthylenesulfonic acid) (I) forms a yellow precipitate with Cr(IV) which is insoluble in water and in acids and is suitable for the gravimetric determination of Zr. No other ions form precipitates with I in acid medium. HF, H_2SO_4, citric, and tartaric acids mask Zr(IV) and interfere with its precipitation by I. In the gravimetric determination of Zr the solution to be analyzed (0.02 to 0.07 g Zr) is diluted with water to 80 to 100 ml, 5 ml of conc HCl are added, and conc I solution is added until the precipitation of Zr is complete, after which the solution is heated to boiling. The resulting precipitate is filtered through a blue ribbon filter [sic], washed with hot 0.2% solution of I, ignited, and weighed as ZrO_2. In order to avoid losses during ignition, the filter with the precipitate is wetted with H_2SO_4. The error of the determination is 0.1 to 0.2%.

1509

DETERMINATION OF MICROGRAM QUANTITIES OF URANIUM IN THORIUM. V. T. Athavale, L. M. Mahajan, N. R. Thakoor, and M. S. Varde (Atomic Energy Establishment, Trombay, India). Anal. Chim. Acta 21, 353-6(1959) Oct.

Uranium present in micro amounts in thorium is extracted with 5% tributyl phosphate in presence of EDTA at ph 2.5. Calcium nitrate is used as salting agent. Uranium is back-extracted with ammonium carbonate and determined fluorimetrically. Thoria samples containing as little as 0.4 ppm of uranium were analyzed. (auth)

1510

FURTHER DEVELOPMENTS IN THE DETERMINATION OF OXYGEN IN BERYLLIUM BY THE MICRO VACUUM FUSION METHOD. E. Booth and A. Parker (United Kingdom Atomic Energy Authority, Woolwich Outstation, Eng.). Analyst 84, 546-8(1959) Sept.

The validity of the technique previously described by Booth and Parker was confirmed, and no modifications are required for the analysis of beryllium containing more than 0.1% of oxygen. By increasing the sample weight to about 50 mg and the weight of platinum in the bath to 10 g, and by using vacuum-melted Specpure tin, the method was successfully applied to the determination of oxygen in beryllium at the 0.01% level, at which the results have a coefficient of variation of 15 to 20% and are in satisfactory agreement with those obtained by fast-neutron activation. The confidence limits quoted indicate that the smallest amount of oxygen that can be detected with reasonable certainty is approximately 20 ppm. (auth)

1511

THE DETERMINATION OF SMALL AMOUNTS OF NEPTUNIUM IN PLUTONIUM METAL. L. J. Slee, G. Phillips, and E. N. Jenkins (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Analyst 84, 596-603(1959) Oct.

A method is described for determining the neptunium content (10 to 2000 ppm) of plutonium metal. The neptunium is separated from plutonium by solvent extraction with 2-thenoyltrifluoroacetone and then determined with a square-wave polarograph. Results show neptunium contents ranging from 25 to 500 ppm. The precision at these two levels is about ±10 and ±2%, respectively. (auth)

1512

THE SPECTROSCOPIC DETERMINATION OF TRACE AMOUNTS OF BORON IN GRAPHITE. II. S. Held and S. Skalska. Chem. Anal. (Warsaw) 2, 327-30(1957). (Translated from Referat. Zhur. Khim. No. 2, 1959, Abstract No. 4332).

A method for the determination of B in graphite capable of detecting 0.5 γ B per g was developed. The spectra are excited in an a-c arc discharge (10 to 12 amp); Cu electrodes 7 mm in diam. are used. The electrodes are provided with openings 6.5 mm in diam. and 5 mm deep, each electrode holding about 0.25 g of powdered sample. The spectra are photographed with a Hilger spectrograph on Agfa photographic plates. An electrode separation of 3 mm is used with an exposure of 2 min. The standards are prepared by mixing graphite containing 0.5 γ B per g with graphite containing 10 to 15 γ B per g. The B content in the standards is calculated by the method previously described. The calibration curves are constructed from the intensity of the 2497.7 A boron line and the background of the line at the background near the short-wavelength edge of the line.

1513

SPECTRAL ANALYSIS OF RARE-EARTH ELEMENTS. O. A. Kul'skaya, E. S. Nazarevich, and K. F. Gudimenko (Inst of Geological Sciences, Academy of Sciences, Ukrainian SSR). Dopovidi Akad. Nauk Ukr. R.S.R. No. 7, 766-73(1959). (In Ukrainian)

A spectrochemical method was developed for determining rare earth elements in artificial mixtures conforming to the mean chemical composition of the sum of the rare earth oxides or of the cerium group. This method is based on the three-stage method. Zirconium is employed as an internal standard. Photographs are taken on a high dispersion spectrograph. A direct current arc serves as the excitation source. The determination limits are Y—0.01 to 3%, Nd—0.3 to 3%, La—0.1 to 3%, Sm—0.1 to 3%, Dy—0.1 to 3%, Gd—0.03 to 3%, Eu—0.03 to 3%, Er—0.01 to 1%, and Yb—0.01% to 1.0%. The error is within limits of ±12%. (auth)

1514

ON THE METHOD OF DETERMINING RARE AND DISPERSED ELEMENTS IN MAGMATIC ROCKS. E. S. Burkser and B. F. Mickiewicz (Mitskevich). Dopovidi Akad. Nauk Ukr. S.S.R. No. 8, 874-7(1959). (In Ukrainian)

Data are presented on a method of concentrating assays of erupted rocks for determining rare and dispersed elements contained in them. The concentration is effected by removing silicic acid, the content of which in the granites is as high as 80%. Preliminary results indicate that this method considerably facilitates the determination of Cr, V, Cu, Pb, Sn, Zn, Ni, Be, Zr, Ga, Nb, and Sc, the concentration of which is increased 3 to 5 times as a result of applying this method. This method does not, however, exclude direct spectral study of rocks, since for a number of elements it is either inapplicable (Ba, Sr, Li, Rb) or unreliable (W, Mo, Y, La). (auth)

1515

BEHAVIOR OF SOME RARE EARTHS DURING THERMAL PROCESSING OF GRAPHITE. P. Leveque, S. Decour, H. Hering, and G. Jouquet (Commissariat a l'Energie Atomique, Saclay, France). Ind. Carbon and Graphite, Papers Conf. London, p.544-7, 1957(Pub. 1958). (In French)

Rare earths in graphite are determined by pile activation and subsequent measurement of the beta decay of Dy. On the assumption that Dy constitutes 7% of the total rare earths, the rare earths in the graphite can be determined. To test this assumption of the Dy percentage, Dy, Eu, and Sm were determined by pile activation in graphite, calcium fluoride, sodium fluoride, zirconia, coke, and tar. The ratios observed for these rare earths in the different materials are variable which casts doubts on the assumption. (J.S.R.)

1516

THE PHOTOMETRIC MICRODETERMINATION OF URANIUM BY AN ACTIVATED REACTION. Gy. Almassy and A. Kiss. Magyar Kém. Folyóirat 64, No. 5, 170-3(1958). (Translated from Referat. Zhur. Khim. No. 2, 1958, Abstract No. 4327).

It was found that in strongly acidic medium Fe(III) will oxidize U(IV) to U(VI). The reaction proceeds in weakly acidic medium if the Fe(II) ions produced are bound in a stable complex, e.g., with α, α -bipyridyl (I). The complexing of Fe(II) with I results in the formation of a red-colored complex which is suitable for photometric measurements. This is the basis for an indirect method of photometric U determination. The sensitivity of the determination is ~ 0.2 γ/ml U. All metals capable of reducing Fe(III) interfere with the determination and the U is therefore extracted from such metals by use of TBP.

1517

A METHOD FOR DETERMINING CARBON-14 BY COMBUSTION USING CALCIUM CARBONATE. E. C. S. Little (Univ. of Oxford). Nature 184, Suppl. 12, 900(1959) Sept. 19.

It was found that calcium carbonate gives an increased counting rate over barium carbonate by a factor of 1.85 ± 0.08. The effects of calcium chloride and a mixture of calcium and magnesium chlorides on the formation of calcium carbonate precipitates are given. (C.J.G.)

1518

SURFACE ANALYSIS BY CHARGED PARTICLE SPECTROSCOPY. Sylvan Rubin (Stanford Research Inst., Menlo Park, Calif.). Nuclear Instr. and Methods 5, 177-83(1959) Sept.

The analysis of the momentum distribution of protons scattered from a solid surface can be used to determine the composition of the surface as a function of depth. Examples of such analyses obtained with a 2-Mev Van de Graaff accelerator and a high resolution magnetic spectrometer are given. The technique is applicable to the detection of all elements to a depth of several microns, with sensitivities in the range of 10^{-8} to 10^{-6} gram per square centimeter. (auth)

1519

RAPID SENSITIVE METHOD FOR DETERMINING H^3-WATER IN BODY FLUIDS BY LIQUID SCINTILLATION SPECTROMETRY. Harold Werbin, I. L. Chaikoff, and Miles R. Imada (Univ. of California, Berkeley). Proc. Soc. Exptl. Biol. Med. 102, 8-12(1959) Oct.

An accurate and convenient method for determination of tritium water in body fluids by liquid scintillation spectrometry is described. The method is based on distillation of body fluids with benzene to provide an almost pure sample of H^3-water, and use of an effective solvent (dioxane-naphthalene) to transfer the excitation energy of tritium to the phosphors, 2,5-diphenyloxazole and 1,4-bis-2 (5-phenyloxazolyl)-benzene. When applied to determination of tritium water in urine and plasma, the method gave recoveries ranging from 98 to 104%. By the new method, metabolism of intravenously administered H^3-β-sitosterol to H^3-water was demonstrated in the guinea pig. (auth)

1520

CO-PRECIPITATION OF ZIRCONIUM WITH TRIVALENT CERIUM OXALATE OBTAINED BY THE METHOD OF (IN STATU NASCENDI) REAGENTS. V. P. Shvedov, N. A. Pavlova, and M. I. Bulatov (Lensovet Technological Institute, Leningrad). Zhur. Anal. Khim. 14, 271-3(1959) Sept.-Oct. (In Russian)

The solubility of cerium oxalate in HNO_3 solutions of various concentrations was established. It was shown that zirconium co-precipitates with trivalent cerium oxalate due to the adsorption process. The co-precipitation of zirconium decreases with increase in acidity of the medium. Zirconium adsorption increases with increase of its concentration in solution, whereas the rate of capture decreases. (auth)

1521

USE OF LOW-TEMPERATURE CARBON ARC AS A SOURCE FOR EXCITATION RUBIDIUM, CESIUM, THALLIUM AND INDIUM SPECTRA IN THE SPECTROGRAPHIC ANALYSIS OF SILICATES. A. K. Rusanov, V. G. Khitrov, and N. T. Batova (All-Union Inst. of Mineral Raw Materials, Moscow). Zhur. Anal. Khim. 14, 534-41(1959) Sept.-Oct. (In Russian)

A low-temperature d-c carbon arc is a valuable source for the excitation of Rb, Cs, Tl, and In spectra on the condition that predominent quantities of potassium vapors are intensively fed into the arc discharge. The method for the quantitative spectrographic determination of Rb, Cs, Tl, and In, based on the excitation of these elements spectra in the low-temperature arc, permits the simultaneous determination of small amounts of Rb, Cs, Tl, and In directly in silicate powders. The mean probable error of the determination is ±9 to 11%. (auth)

1522

DETERMINATION OF CALCIUM, STRONTIUM AND MAGNESIUM BY RADIOMETRIC TITRATION WITH COMPLEXONE. T. Braun, I. Maxim, and I. Galateanu (Inst. of Atomic Physics, Bucharest). Zhur. Anal. Khim. 14, 542-6(1959) Sept.-Oct. (In Russian)

A method was developed for radiometric titration by means of complexing agents with the use of precipitates as non-isotopic indicators. (auth)

1523

COLOR REACTIONS FOR SCANDIUM. I. M. Korenman, V. P. Gunina, and L. K. Trifonova (N. I. Lobachevskii Gorky State Univ.). Zhur. Anal. Khim. 14, 547-9(1959) Sept.-Oct. (In Russian)

Color reactions for scandium with hydroxyanthraquinones and 1,1′-dihydroxyazo dyes are studied. New reactions for scandium are suggested, some of which are highly sensitive and permit the detection of scandium in the presence of other elements. (auth)

1524

INVESTIGATION ON ANALYTICAL CHEMISTRY OF THALLIUM. COMMUNICATION 3. SPECTROPHOTOMETRIC DETERMINATION OF THALLIUM WITH ANTIPYRINE DERIVATIVES. A. I. Busev and V. G. Tiptsova (Lomonosov Moscow State Univ.). Zhur. Anal. Khim. 14, 550-5(1959) Sept.-Oct. (In Russian)

It was shown that the antipyrine derivatives—diantipyrinylmethane and diantipyrinylpropylmethane—precipitate thallium (III) as $C_{23}H_{24}O_2N_4 \cdot HTlI_4$ and $C_{24}H_{30}O_2N_4 \cdot HTlI_4$ in the presence of KI in an acid medium. The compounds $C_{23}H_{24}O_2N_4 \cdot HTlI_4$ and $C_{26}H_{30}O_2N_4 \cdot HTlI_4$ are extracted with benzol; the color of the extract follows Lambert-Beer's law at 400 to 405 mμ. The molar extinction coefficient of the benzol solution of the compounds obtained is 12000 at 400 to 405 mμ and does not depend on the molecular weight of the base precipitant. A method was developed for the spectrophotometric determination of thallium in the presence of Fe, Bi, Cu, Zn, Pb, Cd, Ga, and In. (auth)

1525

QUANTITATIVE DETERMINATION OF THALLIUM AS THALLIUM BICHROMATE. COMMUNICATION 2. DETERMINATION OF THALLIUM IN THE PRESENCE OF OTHER ELEMENTS. N. I. Bashilova (N. S. Kurnakov Inst. of General and Inorganic Chemistry, Academy of Sciences, USSR, Moscow). Zhur. Anal. Khim. 14, 556-61 (1959) Sept.-Oct. (In Russian)

It was found that the quantitative determination of thallium (I) as bichromate in acid solutions is also a quantitative method of separation of thallium from accompanying elements. It was shown that metals which do not form slightly soluble chromates in acid solutions, such as Zn, Cd, Al, Fe, Cu, Mg, Co, Ni, Sb, In, Ga, Ge, Tl^{III}, and Cr^{III}, do not interfere with the determination of thallium as thallium bichromate. Metals forming sparingly soluble chromates, namely Pb, Ag, Bi, and Hg, interfere only when their concentrations exceed certain limiting values. Barium does not interfere at any concentration. The determination of thallium can be carried out not only in sulfuric acid solutions but in the solutions of other mineral acids, such as nitric and perchloric acids. The suitable concentrations of these acids was established. (auth)

1526

COMPLETE SPECTROGRAPHIC ANALYSIS OF MIXTURES OF RARE EARTH OXIDES. R. R. Shvangiradze. Zhur. Anal. Khim. 14, 562-6(1959) Sept.-Oct. (In Russian)

A method is suggested for the complete spectral analysis of mixtures containing commensurable concentrations of components similar to each other in their physico-chemical properties. It is shown that the method of complete analysis is more accurate than the method of addition of an inner standard to the sample. (auth)

1527

ANALYTICAL CHEMISTRY OF THORIUM. COMMUNICATION 1. COMPLEXOMETRIC DETERMINATION OF THORIUM IN MONAZITE CONCENTRATES. Yu. A. Chernikhov, V. F. Luk'yanov, and A. B. Kozlova. Zhur. Anal. Khim. 14, 567-70(1959) Sept.-Oct. (In Russian)

The complexometric titration of thorium was carried out in the presence of uranon (arsenazo) for the determination of thorium in monazite concentrates after its separation as iodate and oxalate by the method of "in statu nascendi" reagents. The method was tested on various samples of monazite concentrates. The accuracy of the method is 0.04% abs. at the concentration of thorium of 5 to 7%. (auth)

1528

DETERMINATION OF ZIRCONIUM WITH N-BENZOYLPHENYLHYDROXYLAMINE. I. P. Alimarin and Yun-Hsiang Tsê (Lomonosov Moscow State Univ.). Zhur. Anal. Khim. 14, 574-7(1959) Sept.-Oct. (In Russian)

A new method was developed for the quantitative precipitation of zirconium with N-benzoylphenylhydroxylamine. The influence of different mineral acids, tartaric acid, and hydrogen peroxide on the completeness of the zirconium precipitation with N-benzoylphenylhydroxylamine was studied. Precipitation of zirconium in the presence of other elements was investigated. It was shown that zirconium can be separated from iron, aluminum, chromium, titanium, niobium, and tantalum. The composition of zirconium benzoylphenylhydroxylaminate was determined; the precipitate separated from a strong acid solution corresponds to the formula $Zr(BPHS)_4$. (auth)

1529

NEW PHOTOMETRIC METHOD FOR DETERMINING VANADIUM. G. V. Rabovskii, T. F. Kuznetsova, and V. A. Belonogova. Zhur. Anal. Khim. 14, 578-80(1959) Sept.-Oct. (In Russian)

The photometric method for determining vanadium is based on the oxidation of phenylanthranilic acid or salts of diphenylaminosulfonic acid with pentavalent vanadium. Fe, U, Cr^{3+}, and Ni do not interfere. (auth)

1530

INVESTIGATIONS ON THE INTERACTION OF HEXAVALENT URANIUM WITH COMPLEXONE III. D. I. Ryabchikov, P. N. Paleĭ and Z. K. Mikhaĭlova (V. I. Vernadskii Inst. of Geochemistry and Analytical Chemistry, Academy of Sciences, USSR, Moscow). Zhur. Anal. Khim. 14, 581-7(1959) Sept.-Oct. (In Russian)

The interaction of the uranyl ion with complexone III in solutions was investigated with the use of ion exchange, and spectrophotometrically, and conductimetrically. Complexing of the uranyl ion with complexone III was found to occur at pH 3. A supposition was made that, depending on the concentrations of complexone III and uranium in solution, two compounds are found with the molar ratio complexone; uranium equal to 1 and 0.5. Complex compounds of uranium with complexone III have little stability; their stability increases from pH 3 to pH 8. Two compounds of uranium with complexone III were isolated, the compositions of which are near to $(UO_2)_2\gamma \cdot 3H_2O$ and $(NH_4)_2(UO_2\gamma) \cdot 3H_2O$. (auth)

1531

MICRO-TITRATION OF RHODIUM WITH SODIUM PIPERIDINEDITHIOCARBAMINATE. N. K. Pshenitsyn and N. V. Fedorenko (N. S. Kurnakov Institute of General and Inorganic Chemistry, Academy of Sciences, USSR, Moscow). Zhur. Anal. Khim. 14, 588-91(1959) Sept.-Oct. (In Russian)

A description is given of a method for determining small amounts of rhodium (0.003 to 0.3 mg) in the solutions of its complex chlorides by the extraction titration of the red products, formed by the reaction between Rh and $SnCl_2$, with sodium piperidinedithiocarbaminate. (auth)

1532

SEPARATION OF SELENIUM AND TELLURIUM. V. I. Plotnikov (All-Union Scientific-Research Mining-Metallurgy Institute of Non-Ferrous Metals, Ust-Kamenogorsk, SSR). Zhur. Anal. Khim. 14, 595-7(1959) Sept.-Oct. (In Russian)

The method for separating selenium and tellurium is based on the selective co-precipitation of tellurium (VI) with $Fe(OH)_3$ in a strong ammonia solution. Selenium (VI) is practically not co-precipitated with $Fe(OH)_3$ under these conditions. (auth)

1533

CHEMICO-SPECTROGRAPHIC ANALYSIS OF ALUMINIUM OF HIGH PURITY. A. G. Karabash, Sh. I. Peĭzulaev, R. L. Slyusareva, and V. M. Meshkova. Zhur. Anal. Khim. 14, 598-602(1959). (In Russian)

The chemico-spectrographic method for analyzing aluminum of high purity is based on chemical concentration of admixtures by precipitation of aluminum as $AlCl_3 \cdot 6H_2O$ with gaseous hydrogen chloride, followed by the spectrographic determination of admixtures in the residual solution concentrate. Twenty elements can be determined simultaneously: Be, Mg, Ca, Ba, Ti, V, Mo, Mn, Fe, Co, Ni, Cu, Ag, Zn, Cd, Pb, Sn, Sb, Bi, and In. Due to the $\approx$50 time concentration of admixtures the sensitivity of the determination is increased up to 10^{-4} to 10^{-6}%. A method for the spectrographic analysis without concentrating admixtures was worked out for the control of industrial production. The sensitivity of the method is 10^{-2} to 10^{-4}%. (auth)

1534

DETERMINATION OF SOME MICRO-ADMIXTURES IN SELENIUM OF HIGH PURITY. O. E. Zvyagintsev and V. I. Shamaev (D. I. Mendeleev Chemico-Technological Institute, Moscow). Zhur. Anal. Khim. 14, 603-5(1959) Sept.-Oct. (In Russian)

A method was developed for the determination of trace amounts of Te, Cu, Ga, As, Sb, and Cd in selenium by the radioactivation analysis. The method suggested for chemical separation and purification of the elements to be determined enables isolating preparations of radiochemical purity. The chemical yield of carriers for Cu, As, and Cd is 50 to 70%, for Te 30 to 50%, and for Sb and Ga 25 to 35%. The accuracy of the determination of individual elements is 10 to 25%. (auth)

1535

BOXES OF NEW DESIGN FOR THE WORK WITH RADIOACTIVE SUBSTANCES. N. I. Gusev, P. N. Paleĭ, I. G. Sentyurin, and I. S. Sklyarenko (V. I. Vernadskii Institute of Geochemistry and Analytical Chemistry, Academy of Sciences, USSR, Moscow). Zhur. Anal. Khim. 14, 606-11 (1959) Sept.-Oct. (In Russian)

Glove boxes of new design are suggested which permit transferring radioactive substances, chemical glassware, and small apparatus from one box to another without any hazard of radioactive contamination of hands and the laboratory air. (auth)

1536

POLAROGRAPHIC DETERMINATION OF BERYLLIUM IN TETRAETHYL AMMONIUM IODIDE. P. N. Kovalenko and O. I. Geĭderovich (Rostov-on-Don State Univ., USSR). Zhur. Anal. Khim. 14, 634-5(1959) Sept.-Oct. (In Russian)

The polarographic determination of beryllium is carried out in a 0.1 M solution of tetraethyl ammonium iodide at pH not higher than 2.2 to 2.4. (auth)

1537

AMPEROMETRIC TITRATION OF GALLIUM WITH COMPLEXONE III IN THE PRESENCE OF PHOSPHATE. N. N. Chudinova (N. S. Kurnakov Inst. of General and Inorganic Chemistry, Academy of Sciences, USSR, Moscow). Zhur. Anal. Khim. 14, 636(1959) Sept.-Oct. (In Russian)

Gallium can be determined in the presence of phosphate by direct amperometric titration with complexone III using the anode current of the complexone oxidation at the potential of 0.8 to 1.0 v (vs. the saturated calomel electrode). (auth)

1538

DETERMINATION OF TELLURIUM IN LEAD ANTIMONY TELLURIUM ALLOYS. I. P. Onufrienok and V. M. Aksenenko (Tomsk Polytechnical Inst., USSR). Zhur. Anal. Khim. 14, 637-8(1959) Sept.-Oct. (In Russian)

A method was developed for the comparatively rapid and accurate determination of tellurium in lead—antimony—tellurium alloys with a titrimetric end. (auth)

Radiation Chemistry

1539 HW-38263(Del.)

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

THE STABILITY OF PUREX SOLVENT TO RADIATION AND CHEMICAL ATTACK. J. L. Swanson. May 24, 1955. Decl. with deletions Aug. 25, 1959. 30p. Contract W-31-109-Eng-52. OTS.

The effects of variables on the rate of Purex solvent deterioration were investigated with the emphasis on those deterioration products which cannot be removed by carbonate washing. The deterioration rate was found to be directly proportional to the acid and nitrate ion concentrations, and proportional to the square root of the concentration of nitrite ion. Other observations on the effects of temperature, relative merits of brand name solvents, and the effects of radiation are included. A method of calculating the equilibrium level of the solvent deterioration products based on study conclusions and various estimates is outlined. (J.R.D.)

1540 WADC-TR-59-286

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

EFFECTS OF NUCLEAR RADIATION ON SOLID CATA-

LYSTS. Period covered: June 15, 1958 – April 30, 1959. Robert H. Bragg, Fred L. Morritz, Richard Holtzman, Paul Y. Feng, and Frank Pizzarello. May 22, 1959. 75p. Project No. 7021. Contract AF33(600)-5896. OTS.

Both gamma ray and fast neutron irradiation causes changes in the electrical characteristics of single crystals and powders of zinc oxide. The two major effects of fast neutrons on single crystals are an enhanced conductivity when the irradiation is begun, and a subsequent decrease as the irradiation is continued up to doses of 10^{15} nvt. A zinc oxide crystal exposed at a dose rate of 10^5R/hr in a Co^{60} gamma field to a dose of 10^9R experienced only displacements. Calculations show that about 3 to 16 charge carriers are removed from the conduction band per incident fast neutron, depending upon the initial carrier concentration, whereas about 0.0035 carriers are removed per incident Co^{60} gamma ray. Calcination of ZnO powders *in vacuo* caused the conductance to increase by a factor of 10^6, and measurements during subsequent in-pile irradiations, up to 10^{14}nvt, indicated a further increase. These results demonstrate a strong dependence of electrical characteristics upon chemical treatment and irradiation and show that the two should produce analogous effects upon the catalytic activity of zinc oxide. Hydrogenation of ethylene occurs readily at 30°C over calcined zinc oxide powder, and a marked increase in activity is observed after further calcination *in vacuo* at temperatures up to 615°C. After irradiation to a dose of 10^{13} nvt the catalytic activity is decreased. A catalyst previously used in hydrogenation experiments suffers a greater loss of activity after irradiation than a freshly calcined catalyst. However, the activity is regained by recalcination. In-pile experiments on the hydrogenation of ethylene over zinc oxide catalyst show that during irradiation the rate of the reaction is increased compared to the rate observed with the freshly calcined material without irradiation. In subsequent *in situ* studies in the absence of radiation the reaction goes more slowly over the irradiated catalyst than over the original material. If radiation is again applied an induction period is observed during which radiation is relatively ineffective; but eventually an enhanced reaction rate is again observed. A subsequent cycle reproduces this behavior qualitatively, but the induction period becomes longer after another irradiation. Rather extensive irradiation experiments were performed on mixtures of hydrogen and ethylene in the absence of a catalyst. The results show that although a measurable amount of polymerization occurs in the gas phase, the changes due to all of the gas phase reactions are too small to account for the effects observed when the catalyst is present. The kinetics for the major reaction are found to be the same as that observed over metal films, i.e., zero order in ethylene and first order in hydrogen. (auth)

1541

RADIATION-INDUCED PRECIPITATION SITES IN POTASSIUM CHLORIDE. S. Amelinckx (Laboratorium voor Kristalkunde, Gent, Belgium). *Acta Met.* *7*, 650-1(1959) Sept.

Crystals of KCl, doped with $AgNO_3$, were x irradiated for 6 hr and annealed in air for 1 hr at 600°C. Nucleation centers for precipitation were observed. (C.J.G.)

1542

A NEW DOSIMETRY METHOD FOR THE MEGARAD RANGE. H. Wilski (Farbwerke Hoechst AG, vormals Meister Lucius and Brüning, Frankfurt/Main-Höchst). *Atomkernenergie* *4*, 402-3(1959)

A method is discussed, utilizing for dose measurements the radiation-induced alterations of the plastic properties of polyethylene (above the crystallite melting point). (auth)

1543

RADIATION PROCESSING. Ernest J. Henley (Stevens Inst. of Tech., Hoboken, N. J.) and Horace W. Chandler (Radiation Applications, Inc., New York). *Ind. Eng. Chem.* *51*, 1395-1402(1959) Nov.

A review of chemical processing uses for ionizing radiation; radio frequencies, plasmas and discharges, solar, ultrasonic and ultraviolet induced reactions is presented. An extensive bibliography is included. (J.R.D.)

1544

RECOIL TRITIUM REACTIONS AT AN ASYMMETRIC CARBON: L(+)-ALANINE. Jack G. Kay, R. P. Malsan, and F. S. Rowland (Univ. of Kansas, Lawrence and Princeton Univ., N. J.). *J. Am. Chem. Soc.* *81*, 5050-3(1959) Oct. 5.

Recoil tritium reactions with L(+)-alanine were investigated in both crystalline form and in aqueous solution. The T for H substitution at the asymmetric carbon atom occurs with complete retention of configuration in the crystal and occurs for 0.01 % of the total tritium in the liquid solution. More than 85% of the T for H substitutions in the methyl group in both cases proceed with retention of optical configuration. (auth)

1545

THE ISOTOPE EFFECT AND ITS RELATION TO THE VALIDITY OF ISOTOPIC TRACER EXPERIMENTS. Clair J. Collins and M. H. Lietzke (Oak Ridge National Lab., Tenn.). *J. Am. Chem. Soc.* *81*, 5379-83(1959) Oct. 20.

The ORACLE was employed to determine, for first-order irreversible reactions, the relation between fraction of reaction ($f = 1 - e^{-kt}$) and the accumulated product ratio R[$R = (1 - e^{-k^*t}/1 - e^{-kt})$] over a range of values for the isotope effect (k^*/k) of 0.05 to 0.99. Similar calculations were made for f as a function of the ratio (x) of the differentials of the fractions of labeled to unlabeled molecules formed. All results are presented graphically, and are discussed with respect to their possible effect upon the validity of certain experiments with isotopic elements. (auth)

1546

CALCULATION OF THE RATE OF ENERGY DEPOSITION IN POLYETHYLENE BY REACTOR RADIATION. D. E. Kline and A. Jacobs (Pennsylvania State Univ., University Park). *J. Appl. Phys.* *30*, 1741-7(1959) Nov.

An attempt is made to determine the energy deposited in a small sample in terms of impinging reactor radiations, both neutron and gamma ray. The intensities of various radiations from a nuclear reactor are often presented in terms which are difficult to manipulate or interpret for energy deposition considerations. For example, the epithermal neutron flux is usually given as the integral neutron flux above the 0.4 ev cadmium resonance. However, for some energy deposition mechanisms, such as proton recoil, the neutron energy distribution is of utmost importance. These difficulties are partly resolved by using some empirical evidence of the characteristics of reactor radiations to convert the usual expression of intensities into energy deposited per gram-hour in polyethylene. This can be easily extended to other materials, particularly polymers. It is also emphasized, by specific calculations for two reactor types, that certain simplifying assumptions, which are often made with regard to the characteristics of reactor radiation, are invalid in energy deposition considerations. (auth)

1547

NUCLEAR MAGNETIC SHIELDING OF F^{19} IN SOME CHLOROFLUOROCARBONS. T. S. Smith and E. A. Smith (Goodyear Atomic Corp., Portsmouth, Ohio). J. Phys. Chem. 63, 1701-3(1959) Oct.

The positions of the nuclear magnetic resonance lines of the various F^{19} groups in dichlorotetrafluoroethane (CCl_2FCF_3 and $CClF_2CClF_2$), trichlorotrifluoroethane (CCl_2FCClF_2), trichlorofluoromethane (CCl_3F), perfluorodimethylcyclohexane (C_8F_{16}), and trichloroheptafluorobutane ($CF_3CCl_2CClFCF_3$) have been measured with respect to the F^{19} line of trifluoroethanoic acid (CF_3COOH). The magnetic shielding constant for the F^{19} groups increases with an increase of the total electronegativity of the atoms associated with the nearest carbon atom. (auth)

1548

RADIATION CHEMISTRY OF POLYVINYL CHLORIDE. A. A. Miller (General Electric Co., Schenectady, N. Y.). J. Phys. Chem. 63, 1755-9(1959) Oct.

The irradiation, with high-energy electrons, of the polyvinyl chloride structure, $-CH_2CH(Cl)-$ was studied. Radiation yields for HCl were determined as a function of temperature. Post-irradiation changes in vacuo and in air, were measured by electron paramagnetic resonance and by visual observation of color. It is concluded that the major primary chemical processes are the formation of $-CH_2\dot{C}H- + Cl.$ and $-CH{=}CH- + HCl$. A free-radical chain dehydrochlorination, involving the unstable $-CHCH(Cl)-$ radical, appears to explain the development of conjugated unsaturation. The radiation yield for HCl increases with temperature from a minimum value of $G = 5.6$ at −90°C and below, to $G = 23$ at 70°C. (auth)

1549

ATOMS AND FREE RADICALS BY γ-IRRADIATION AT 4.2°K. Leo A. Wall, Daniel W. Brown, and Roland E. Florin (National Bureau of Standards, Washington, D. C.). J. Phys. Chem. 63, 1762-9(1959) Oct.

In nitrogen, hydrogen and deuterium at 4.2°K radiolysis produces atoms which are immobilized. They were identified by electron spin resonance (e.s.r.). In irradiated methane both hydrogen atoms and methyl radicals were found in approximately equal amounts. Repeated irradiation of the same samples in all cases led to more efficient production of active species. Added oxygen (0.07%) reduced the nitrogen atom yield of the initial run. Yields were studied as a function of irradiation dose. The maximum nitrogen atom concentration attained in solid nitrogen was 0.06%, while in irradiated methane 0.15% of hydrogen atoms and 0.14% of methyl radicals were attained. Because of saturation of the e.s.r. spectra, the results with hydrogen and deuterium are low. High-energy radiation at low temperatures in general appears to be a useful and promising method for the production of stabilized free radicals or atoms. (auth)

1550

CHEMICAL EFFECTS OF (n,γ) ACTIVATION OF BROMINE IN THE ALKYL BROMIDES: A NEW METHOD FOR DETERMINATION OF ORGANIC RETENTION. W. E. Harris, W. H. McFadden, and R. G. McIntosh (Atomic Energy of Canada, Ltd., Chalk River, Ont.). J. Phys. Chem. 63, 1784-5(1959) Oct.

A method of determining the radiobromine existing in organic and inorganic forms after nuclear transformations in alkyl bromides is described. A gaseous absorption technique is used involving potassium ferrocyanide and charcoal for the bromine–hydrogen bromide fractions respectively. Data on organic retention are tabulated. (J.R.D.)

1551

IONIZING RADIATION AND POLYMERS. Rudolf Rado (Výskumný ústav káblov a izolantov, Bratislava, Czechoslovakia). Jaderná energie 5, 304-8(1959). (In Czech.)

Literature concerning the influence of ionizing radiation on macromolecular substances is reviewed. From this point of view, some established relations determining the course of polymerization reactions initiated by ionizing radiation, the radiochemical preparation of grafted copolymers, and the effect of radiation on solid polymers resulting either in degradation or in the formation of a cross-linked structure are treated. 64 references. (auth)

1552

COLOUR CENTRES PRODUCED BY RADIATION IN SILICA GEL. Harold W. Kohn (Oak Ridge National Lab., Tenn.). Nature 184, Suppl. No. 9, 630-1(1959) Aug. 22.

Irradiation of silica gel degassed at 500°C or above with comparatively small doses of cobalt-60 gamma or x radiation was observed to produce a marked magenta coloration of the gel. Possible connection with radiation enhancement of catalytic activity is discussed. (C.H.)

1553

AROMATIC RING OPENING IN THE PRESENCE OF OXYGEN IN IRRADIATED SOLUTIONS. Israel Loeff and Gabriel Stein (Hebrew Univ., Jerusalem). Nature 184, Suppl. 12, 901(1959) Sept. 19.

When aqueous solutions of benzene are irradiated in vacuo with α-particles or neutrons, mucondialdehyde is produced. It was found that mucondialdehyde is formed simultaneously with phenol, directly from benzene, without previous formation of phenol, catechol, quinol, or quinones. (C.J.G.)

1554

OXIDATION OF CHLOROBENZENE IN AQUEOUS SOLUTIONS BY THE ACTION OF IRRADIATION. N. P. Krushinskaya and M. A. Proskurnin (L. Ya. Karpov Inst. of Physical Chemistry, Moscow). Zhur. Fiz. Khim. 33, 1954-61(1959) Sept. (In Russian).

The radiolytic oxidation of chlorobenzene in aqueous solutions was studied in vacuum and on continuous passage of oxygen. Under vacuum conditions analysis of the gaseous products showed the presence of oxygen and the complete absence of hydrogen. It was found that in addition to phenol and the isomers of chlorophenol non-phenolic types of compounds representing hydrogenated derivatives of diphenyl are formed. The presence of molecular oxygen leads to a threefold increase in the yield of phenols at the expense of the hydrogenated condensation products. An important part in this process was shown to be played by the radiation hydrolysis of chlorobenzene. On the basis of the data obtained the mechanism of hydroxylation of chlorobenzene was investigated. (auth)

1555

ISOTOPIC EXCHANGE OF SULFUR IN THIURAMS AND DITHIOCARBAMINIC ACID ESTERS. L. S. Kuzina and E. N. Gur'yanova (L. Ya. Karpov Inst. of Physical Chemistry, Moscow). Zhur. Fiz. Khim. 33, 2030-5(1959) Sept. (In Russian).

The isotopic exchange of the sulfur of thiurams, dithiocarbaminic acid esters, and isothiocyanates (in all 15 compounds) with radioactive elementary sulfur was investigated. The number of exchangeable sulfur atoms in the compounds was established, as well as the optimal conditions for exchange. The activation energies were determined for 7 compounds. The exchange rate of thiurams with elementary sulfur increases with increasing number of sulfur atoms in the polysulfide bridge. In tetramethylthiuramtetrasulfide the two middle sulfur atoms exchange the most easily, whereas the four extreme ones, connected with carbon atoms, are somewhat more sluggish in the reaction, although the difference is not so great as to permit the carrying out of separate exchange. Substitution of aliphatic for phenyl radicals in thiuramdisulfides causes a considerable fall in the rate of exchange. A difference was established in the effects of the aminogroup radicals on the exchange in thiurams and dithiocarbaminic acid esters. The results of the isotopic exchange of sulfur in the compounds studied were considered from the point of view of their activity as accelerators of rubber vulcanization. (auth)

1556
ADVANCES IN CHEMICAL PHYSICS. VOLUME II. I. Prigogine, ed. New York, Interscience Publishers, Inc., 1959. 418p.

The aim of this paper is to discuss in some detail the whole problem of the effect of the action of high energy radiation on solids as studied by quadrupole resonance. A new method was developed for studying nuclear quadrupole resonance in crystals, which is based on the estimation of the intensity of the quadrupole lines. The method is simple but is not very sensitive. Radiation doses of σ 10^6 roentgens are required in order to observe changes in intensity. (W.L.H.)

Radiochemistry

1557 IEA-2
São Paulo, Brazil. Universidade. Instituto de Energia Atômica.
RADIOISÓTOPOS ARTIFICIAIS PREPARADOS COM O REATOR IEA R-1. (Artificial Radioisotopes Prepared with the IEA R-1 Reactor). [1958]. 91p.

A catalog of the radioisotopes prepared by the IEA R-1 Reactor, their characteristics, method of formation, cross section, and specific activity is presented. (J.S.R.)

1558
THE EXCHANGE OF OXYGEN-18 BETWEEN CELLULOSE, ADSORBED WATER, AND WATER VAPOR. A. R. G. Lang and S. G. Mason (McGill Univ., Montreal, Can.). Can. J. Chem. 37, 1829-33(1959) Nov.

The adsorption on regenerated cellulose of water at vapor pressures of 0 to 40 μ Hg was measured by an oxygen-18 dilution technique. The results showed that cellulose may be dried to less than 0.04% moisture by evacuation at 70°C. The adsorption isotherm was compared with that of Taylor for viscose rayon. It was also shown that oxygen-18 does not exchange between cellulose and water. (auth)

1559
AN APPARATUS FOR THE VACUUM DEPOSITION OF RADIO ACTIVE MATERIALS. W. Parker (Univ. of Uppsala). Nuclear Instr. and Methods 5, 142-7(1959) Sept.

An apparatus is described for the preparation of radioactive sources by means of vacuum deposition for use in nuclear spectroscopy. The collimated crucibles described allow for smaller amounts of active material to be used in the preparation because of the higher yield obtained. Also the risk of contamination to the vacuum system is greatly reduced. Special attention is paid to the preparation of sources of the point of the strip variety. Total yields obtained from the evaporations and curves showing the distribution of active deposits, together with a list of sources so far prepared in this manner, are given. (auth)

1560
THE SEPARATION OF RADIUM FROM RADIUM D, RADIUM E, AND POLONIUM USING ETHYL-LENEDIAMINE-TETRAACETATE. V. Vebersik and K. Horava. Z. anal. Chem. 162, 401-7(1958). (Translated from Referat. Zhur. Khim. No. 2, 1958, Abstract No. 4282).

A complexometric method for the separation of Ra^{226} from long-lived active precipitates of RaD, RaE, and Po was developed. The method is based on the ability of these precipitates to form stable complexes with complexone III in contrast to Ra^{226}. When $(NH_4)_2SO_4$ is added to the test solution in the presence of complexone III it precipitates only the Ra^{226} as $RaSO_4$. The Ra-salt to be analyzed is dissolved in 100 ml water, 3 drops of 20% HCL are added together with 10 ml of a pH 4.5 acetate buffer solution (130 ml conc CH_3COH, 200 ml NH_4OH, and 200 ml doubly distilled water) and 10 ml of a 1% solution of I. The mixture is refluxed until the quantitative conversion of RaD, RaE, and Po into complexes with I, 3 ml of 10% $(NH_4)_2SO_4$ are added, and the solution allowed to stand for 6 hrs. The precipitate of $RaSO_4$ which is formed is filtered off (blue-ribbon filter [sic]) and washed with a 1% solution of $(NH_4)_2SO_4$. It was found that the $RaSO_4$ precipitate is soluble when refluxed in a 3 to 5% ammoniacal solution of ethylenediaminetetraacetic acid. When the solution thus obtained is acidified with acetic acid to a methyl red end point, followed by refluxing and long standing at room temperature, a precipitate of large crystals of $RaSO_4$ is formed. A determination of Ra^{226} by γ- and of RaD and RaE by β-activity (Po is determined by α-activity) has shown that the loss of Ra during the operations is 10^{-5} gm per 100 gms water and the loss of RaD, RaE, and Po, ±3%.

Raw Materials and Feed Materials

1561 BM-RI-5521
Bureau of Mines.
EXTRACTION OF YTTRIUM AND RARE-EARTH ELEMENTS FROM A EUXENITE CARBONATE RESIDUE. Van E. Shaw, Donald J. Bauer, and John M. Gomes. Apr. 1959. 18p.

Three comparatively simple, efficient, and rapid extraction methods for the dissolution of yttrium and rare-earth elements from a euxenite carbonate residue have been developed, using dilute sulfuric acid as the solvent. Extraction processes have resulted in yields of 98+ % of the total rare-earth elements and yttrium contained in the residue and have given preliminary separation between the cerium-group and the yttrium-group rare-earth elements. (auth)

1562 BM-RI-5531
Bureau of Mines.
EXTRACTIVE METALLURGY OF EUXENITE. S. L. May, J. L. Tews, A. W. Henderson, and W. G. Gruzensky. Feb. 1959. 20p.

Results of this study demonstrate that multiple-oxide minerals can be processed to usable compounds by the techniques described. The chlorination procedure offers an efficient method for extracting tantalum, niobium, uranium, titanium, thorium, and the rare-earth elements from their ores. Separation of the chloride products into four groups is of additional benefit for processing materials such as euxenite. The solvent-extraction system used for continuous separation of tantalum and niobium yields pure compounds of the two metals. Conditions used for the hydrometallurgical processing of the residue from the chlorination and of the chloride eutectic were determined in laboratory scale tests and then applied to the large-scale run. Recovery and purity of the products of the large-scale run were not as satisfactory as small-scale tests had indicated would be possible. However, the general procedures were adequate for the processing, and probably the recovery and purity of products would be improved considerably under optimum conditions for large-scale processing. (auth)

1563 JEN-10
Spain. Junta de Energia Nuclear, Madrid.
ATAQUE ALCALINO Y BENEFICIO DE MINERALES DEL GRUPO DE LA URANITA. (Alkaline Attack and Beneficiation of Minerals of the Uranite Group). R. Fernandez Cellini, T. Batuecas Rodriguez, and J. Vera Palomino. 1956. 18p.

The radioactive minerals from Venta de Cardeña (Cordoba), with an average U_3O_8 content of 0.4% in the form of metaautunite I and torbernite can be beneficiated with almost quantitative yield by heat treatment (80 to 90°C) for three hours with 3% solution with sodium carbonate. From the uranyl carbonate complex high purity uranium peroxide can be precipitated quantitatively by acidification with nitric acid to pH 2, after addition of hydrogen peroxide and heating to 60°C. At room temperature with pH 5, it is possible to precipitate high purity uranyl phosphate from the leach solution with a yield of 98%. (tr-auth)

1564 JEN-28
Spain. Junta de Energia Nuclear, Madrid.
RECUPERACIÓN DE URANIO DE SOLUCIONES ALCALINAS DE BAJA CONCENTRATIÓN CON RESINAS CAMBIADORAS DE ION. (Recovery of Uranium from Low Concentration Alkaline Solutions with Exchange Resins). B. Lopez and L. Gutierrez Jodra. 1957. 23p.

The (0.1 gr/l of U_3O_8) ion exchange recovery of uranium from low concentration carbonate solutions was investigated with Dowex-1, Dowex-2, and Lewatit-MN resins. The optimum conditions for the adsorption and elution phases were determined. The results showed that in the adsorption phase the velocity must not exceed 0.75 l/hr cm^2 if a high uranium recovery (98%) is to be obtained. The fluid dynamics of the two families of resins are distinct, and these are tabulated. The volume of entrained water necessary is independent of the velocity used in the elution. (J.S.R.)

1565 JEN-31
Spain. Junta de Energia Nuclear, Madrid.
ESTUDIO EN PLANTA PILOTO DE LA RECUPERACIÓN DE URANIO DE SOLUCIONES ALCALINAS CON RESINAS CAMBIADORAS DE ANIÓN). (Pilot Plant Study of the Recovery of Uranium from Alkaline Solutions with Anion Exchange Resins). B. López Pérez, A. Uriarte, and L. G. Jodra. 1957. 45p.

The results of the laboratory study on the recovery of uranium from low concentration carbonate solutions (JEN-28) led to a pilot plant study of ion exchange recovery of uranium. The design and operation of the plant is described in some detail. Dowex-2 was the resin selected, and the temperature of the liquids used does not exceed 20°C. The results showed that the leach solution should be clarified before introduction into the exchange columns. For high exchange yield the feed flow cannot be higher than 48 l/hr. The optimum cycle found had an adsorption phase of 16 hr. In this cycle the residual water had a U_3O_8 concentration of 10 mg/l, and a recovery rate from the feed solution of 98.5%. The ión exchanger capacity can be increased by increasing the concentration of the feed. The fixation of silicon by the resins necessitates periodic washing with 5% NaOH. (J.S.R.)

1566 JEN-32
Spain. Junta de Energia Nuclear, Madrid.
MÉTODOS DE CÁLCULO DE ESPESADORES POR ENSAYOS DISCONTINUOS. (Methods for the Calculation of Settling Tanks for Batch Experiments). P. Gasos, C. Perez Perea, and L. G. Jodra. 1957. 27p.

In order to calculate settling tanks, some tests on batch sedimentation were made, and with the data obtained the dimensions of the settling tank were found. The mechanism of sedimentation is first briefly described, and then the factors involved in the calculation of the dimensions and the sedimentation velocity are discussed. The Cloe and Clevenger method and the Kynch method were investigated experimentally and compared. The application of the calculations are illustrated. It is shown that the two methods gave markedly different results. (J.S.R.)

1567 JEN-33
Spain. Junta de Energia Nuclear, Madrid.
ENSAYOS DE SEDIMENTACIÓN DISCONTINUA EN EL LABORATORIO CON MINERAL DE VENTA DE CARDEÑA. (Experiments with Batch Sedimentation in the Laboratory Venta de Cardeña Mineral). J. M. Josa, M. Perarnau, and L. G. Jodra. 1957. 19p.

Batch sedimentation studies were made on acid and alkaline concentrates of ores from Venta de Cardeña to determine if it were possible to use countercurrent decantation to obtain a liquid-solid separation. The concentrate of milled ore which has not been leached has good sedimentation properties. It is easy to obtain with the addition of a coagulant, but no flocculant, a concentrate with 50% solids. The concentrate from acid leaching requires large quantities of coagulant to obtain a clear supernatant. Alkaline concentrate diluted with water has a turbid supernatant and low final density of concentrate. Of the flocculants tested, the most efficient are Guartec and Separan which require only 0.05 g of flocculant/kg of solid in acid concentrates to give a clear supernatant with a high velocity sedimentation. In the alkaline concentrates the flocculants were less efficient, requiring 0.5 g/kg for a clear supernatant. (tr-auth)

1568 JEN-34
Spain. Junta de Energia Nuclear, Madrid.
LA LIXIVIACIÓN CON ÁCIDO SULFÚRICO DEL MINERAL DE VENTA DE CARDEÑA (CÓRDOBA). I. ESTUDIO EN ESCALA DE LABORATORIO. (The Sulfuric Acid Leaching of the Venta de Cardena (Cordoba) Mineral. I. Study on a Laboratory Scale). 1957. 30p.

The conditions affecting the sulfuric acid leaching of uranium ores from Venta de Cardena were studied on a laboratory scale. The effects of grain size, acid concentration, liquid-solid ratio, temperature, presence of oxidizing agents, and agitation time were investigated. The results led to the establishment of the conditions for the selective leaching of the ores, and these conditions are tabulated. (J.S.R.)

1569 JEN-35
Spain. Junta de Energia Nuclear, Madrid.
ENSAYOS DE FILTRACION DE SOLUCIONES DE DISOLUCION DE URANATO SODICO CON ACIDO NITRICO. (Experiments on the Filtration of Solution of Sodium Uranate with Nitric Acid). J. M. Clement, A. P. Luiña, and L. G. Jodra. 1957. 15p.

In the recovery of uranium from leach solutions, the pilot plant of the J.E.N. does not clarify the solution and the sodium uranate carries with it a high proportion of impurities. Therefore, a study was made to determine the optimum conditions for the filtration of sodium uranate from nitric acid solution and to establish modifications in the dissolution processes at present in use for the concentrates. The effects of pressure, addition of $CaSO_4$ and Kieselgur, pH, and temperature were investigated. The modifications made to the pilot plant as a result of these studies are briefly described. (J.S.R.)

1570 JEN-52
Spain. Junta de Energia Nuclear, Madrid.
RECUPERACIÓN DEL URANIO DE SOLUCIONES. DE CARBONATO SÓDICO MEDIANTE INTERCAMBIO ANIÓNICO CON RESINA DOWEX I. (Recovery of Uranium from Sodium Carbonate Solutions with Dowex I Anion Exchangers). M. Urgell, J. A. Pérez Bustamante, T. Batuecas Rodriguez, F. de la Cruz, and R. Fernández Cellini. 1959. 61p.

Synthetic carbonate solutions were used to study the recovery of uranium with Dowex-1. In the first part of the study the capacity of the resin for uranium fixation is investigated as a function of the solution concentration, and the flow velocity. The ideal thickness of the resin bed is investigated. The optimum conditions for elution with various salts and salt mixtures are established. In the last part, the interference caused by an excess of carbonate and the presence of aluminate or phosphate is considered. (J.S.R.)

1571 K-1248(Del.)
Oak Ridge Gaseous Diffusion Plant, Tenn.
DEVELOPMENT OF THE CONTINUOUS METHOD FOR THE REDUCTION OF URANIUM HEXAFLUORIDE WITH HYDROGEN—PROCESS DEVELOPMENT. COLD WALL REACTOR. S. H. Smiley, D. C. Brater, and R. H. Nimmo. May 22, 1956. Decl. with deletions Aug. 21, 1959. 32p. OTS.

A continuous process for the reduction of uranium hexafluoride to uranium tetrafluoride was developed and proven on a pilot plant scale. Complete conversion to uranium tetrafluoride was realized by contacting a mixture of gaseous uranium hexafluoride and fluorine with hydrogen in a vibrated, vertical, open-tube reactor. The finely divided solid product contained few metallic impurities and the packed density of the material could be varied between 2.2 and 3.7 grams per cd. by regulating the amount of fluorine added. (auth)

1572 K-1249(Del.)
Oak Ridge Gaseous Diffusion Plant, Tenn.
DEVELOPMENT OF THE CONTINUOUS METHOD FOR THE REDUCTION OF URANIUM HEXAFLUORIDE WITH HYDROGEN. Summary Report on Pilot Plant Performance: July 25 through September 15, 1953. R. H. Nimmo, L. F. Parsly, Jr., D. C. Brater, and S. H. Smiley. May 22, 1956. Decl. with deletions Aug. 21, 1959. 43p. OTS.

In order to obtain additional data on performance of the equipment, the uranium hexafluoride reduction pilot plant was modified and operated for 277 hr at design conditions. A complete uranium balance was maintained during this period, and no measurable loss occurred. Experimental results show good operation and excellent product quality. A detailed evaluation of equipment performance and maintenance experience is presented. (auth)

1573 K-1379(Del.)
Oak Ridge Gaseous Diffusion Plant, Tenn.
DEVELOPMENT OF THE CONTINUOUS METHOD FOR THE REDUCTION OF URANIUM HEXAFLUORIDE WITH HYDROGEN—PROCESS DEVELOPMENT. HOT WALL REACTOR. S. H. Smiley and D. C. Brater. June 27, 1958. Decl. with deletions Aug. 21, 1959. 18p. OTS.

A continuous process for the reduction of uranium hexafluoride to uranium tetrafluoride was developed and proved on a pilot-plant scale. Complete conversion to uranium tetrafluoride was realized by contacting gaseous uranium hexafluoride with hydrogen in a heated, vertical, open-tube reactor. The purity and density of the solid product met metal grade uranium tetrafluoride specifications. Some difficulty with the accumulation of fused uranium fluorides in the tower was encountered, however, and it was necessary to stop and deslag the unit about every 8 to 24 hours. The reaction of uranium hexafluoride with gaseous trichloroethylene was studied before the tests with hydrogen were made. Although the reduction to uranium tetrafluoride was complete, the solid product was highly contaminated with the organic by-products of the reaction and was quite low in density. Tests of this method were discontinued when promising results were obtained with hydrogen as the reductant. (auth)

1574 MCW-1433
Mallinckrodt Chemical Works. Uranium Div.,
Weldon Spring, Mo.
PROCESS DEVELOPMENT QUARTERLY REPORT. J. U. Shepardson and J. A. Nelson, eds. Nov. 2, 1959. 95p. Contract W-14-108-Eng-8. OTS.

The performance characteristics of an open auger and an enclosed auger in sampling drums of ore concentrates were determined experimentally. The enclosed auger was found superior in obtaining a proportionate amount of material from the bottom of the drum, obtaining a representative sample of material of variegated particle size, and eliminating the effects of top collapse of free-flowing material. The use of aqueous feed to approach uranium saturation of the organic extract has been studied in the pilot plant. The applicability of an electrostatic precipitator to extract deentrainment has been studied on a pilot-plant scale. A process for solvent treatment with dilute sulfuric acid has been evaluated in the pilot plant. The modified fluid-bed denitrator has produced UO_3 with 90% of the material coarser than 100 mesh. Dissolution of uranic oxide in hot sodium bicarbonate solution was shown to be applicable to the determination of urano-uranic oxide in orange oxide. The procedure is superior, with respect to complete recovery of the urano-uranic oxide, to the current hydrochloric acid dissolution method. A close approach to piston flow was demonstrated in the pilot-plant fluid-bed reduction reactor with $-40 + 270$ mesh UO_3. The interrelationships between the surface area of green salt, AOI, and the temperature of production were demonstrated. Hanford and British continuous-process UO_3 were most sensitive to thermal damage, and a flame-process-UO_2-derived UF_4 least sensitive of those samples tested. The effect of thorium impurity on the surface area of UO_3 previously reported by the National Lead Company of Ohio was confirmed by measurements on production samples. The "long soak" technique for producing low-hydrogen uranium can be improved by removing the hydrogen-containing gas from the interstitial spaces by helium purge. Effective production of metal with less than 2 ppm hydrogen in production dingots, by long-soak techniques, is apparently limited to green salt with less than 50 ppm hydrogen, if current plant heating practices are used. The water content of green salt is apparently related to the humidity in the green salt plant at the time of production. Design and performance data are presented for application of the

Bendix time-of-flight mass spectrometer to analysis of multicomponent gas mixtures, reduction (thermite) bomb gases, and hydrogen-bearing gases evolved from heated uranium tetrafluoride and uranium tetrafluoride-magnesium blends. High-speed recordings of temperature distributions within the 3300-lb dingot bomb charge reveal that the propagation of the thermite reaction is nonuniform both in the geometrical advance of the reaction front and in the reaction rate. The direct vacuum casting to ingot shape of the molten product of a 3300-lb dingot bomb appears to be technically feasible, provided that adequate preheat of the molds is supplied to avoid the formation of cold-shuts. Extrusion defects may be avoided with the aid of press scalping; yields are thereby favorably improved. Dingot heavy-wall tubes can be pierced and extruded in the gamma phase—acceptable concentricity will depend on better container guidance. Further x-ray studies of end-quenched Jominy bars confirm earlier findings that at high cooling rates there is a strong development of [100] poles parallel to the direction of heat flow. At intermediate cooling rates the [100] texture gives way to [111] textures. Cooling rates less than 100°F per second result in nearly random structures. These qualitative conclusions are valid for gamma-extruded, alpha-rolled dingot and iron-alloyed dingot uranium, as well as for alpha-rolled ingot metal. (auth)

1575 MCW-1437
Mallinckrodt Chemical Works. Uranium Div., Weldon Spring, Mo.
DE-ENTRAINMENT OF ORGANIC EXTRACT BY ELECTROSTATIC PRECIPITATION. W. C. Philoon and J. T. Krieg. Nov. 6, 1959. 9p. Contract W-14-108-eng-8. OTS.

A pilot-scale electrostatic precipitator was evaluated in the Weldon Spring uranium refinery as a de-entrainment device for purifying organic extract. During the 4-week test period the treater required no maintenance and very little operator attention. Optimum performance occurred when the extract had at least one stage of washing prior to electrostatic treatment. Feed to the precipitator contained as much as 10% entrained material. With good temperature control, effluents containing as little as 0.001% entrained material were obtained. (auth)

1576 NLCO-786
National Lead Co. of Ohio, Cincinnati.
ENGINEERING EVALUATION OF SEMI-WORKS ADU PRODUCTION. Donald J. Loudin. Mar. 13, 1959. 32p. Contract AT(30-1)-1156. OTS.

Semi-works production of both calcined and uncalcined ADU precipitate has been accomplished at a production rate of approximately one ton per day. (ADU is a precipitate obtained by adding aqueous ammonia to aqueous uranyl nitrate solution.) The plant, designed on the basis of pilot plant data, was operated over a period of nearly six months to produce ADU indistinguishable from that made in pilot plant operation. The semi-works process has demonstrated the technical feasibility of the large-scale production of ADU precipitate at a precipitation pH of 5.7. The product material of the semi-works plant has been shown to be uniformly reactive and to possess a tap density of 2.54 g/ml. Significant decontamination of several impurities has been indicated. Substantiation of this effect has been obtained for sodium and iron. High (>90 per cent) on-stream and yield factors are possible for a plant-scale process. (auth)

1577 NYO-2039
New Brunswick Lab., AEC, N. J.
SUMMARY REPORT ON THE LONG RANGE PROGRAM FOR THE PERIOD ENDING FEBRUARY 15, 1953. C. J. Rodden. Apr. 15, 1953. Decl. Aug. 19, 1959. 140p. OTS.

Moving-Bed Process for the Preparation of UO_2 and UF_4. The preparation of UF_4 by reduction of UO_3 to UO_2 followed by hydrofluorination was demonstrated in a moving-bed bench scale reactor. Pellets of UO_3 were formed and were shown to have sufficient mechanical strength to pass through the reduction and hydrofluorination stages without disintegration. Kinetic data on pelleted material showed the approximate temperature range and residence time for these reactions. Fluidized Process for the Production of UO_2 and UF_4. The fluidization of UO_3, UO_2, and UF_4 was demonstrated. A bench scale fluid bed unit was partially constructed but further work on this process was discontinued in favor of the moving-bed process. Production of Uranium Metal from Uranium Oxides. Massive metal was prepared by direct reduction of UO_3 with calcium. Yields were poor. Powdered uranium was prepared by reduction of UO_2 with calcium. Yields of greater than 90% were obtained. Preliminary experiments indicated that nitric acid may be used for the separation of calcium oxide from uranium powder. Extractive Distillation of Hydrofluoric Acid from its Aqueous Solution. The feasibility of using sulfuric acid for the separation of anhydrous HF from aqueous HF was investigated. Vapor-liquid data for the ternary system $HF-H_2O-H_2SO_4$ are presented. A three inch column was designed and constructed for the separation of 70% HF from $HF-H_2O-H_2SO_4$ mixtures. Simple corrosion tests were made to select promising corrosion-resistant materials for the column. Recovery of Hydrogen Fluoride from Magnesium Fluoride Scrap. Laboratory tests showed that dilute sulfuric acid was unsuitable for the recovery of hydrogen fluoride from magnesium fluoride scrap. A few tests with concentrated sulfuric acid indicated that hydrogen fluoride might be recovered from magnesium fluoride slag about as readily as from commercial fluorspar. (auth)

Separation Processes

1578 BM-RI-5536
Bureau of Mines.
DEVELOPMENT OF EQUIPMENT AND PROCESS FOR EXTRACTION CERIUM(IV). D. J. Bauer. Apr. 1959. 18p.

Separation and purification of cerium compounds are described. The use of spray-tower-type equipment to perform the function of extracting, washing, and stripping was investigated. Feed solutions were prepared on a bench scale from sulfated bastnasite concentrate resulting in 86% recovery of the cerium at 99.7% purity. (J.R.D.)

1579 CF-59-7-76
Oak Ridge National Lab., Tenn.
PRFR PILOT LEACHING PLANT—PRELIMINARY PROCESS DESIGN. H. A. McLain. July 23, 1959. 50p. Contract [W-7405-eng-26]. OTS.

The preliminary process design of a PRFR pilot leaching plant, the proposed location of which is in Cell B of Building 3026 at ORNL, is considered. Chemical, physical, and nuclear parameters are investigated to assure safe leaching operations. Nitric acid solvents are used for leaching the uranium and/or thorium from the sheared spent fuel elements, and the dissolved fuel is sent through a shielded pipeline to the extraction plant for further processing. Recommended materials of construction are 304L stainless steel and 309SCb stainless steel, and maintenance is by direct procedures. (auth)

1580 CF-59-9-85
Oak Ridge National Lab., Tenn.
CHEMICAL TECHNOLOGY DIVISION, CHEMICAL DEVELOPMENT SECTION C, MONTHLY PROGRESS RE-

PORT, SEPTEMBER 1959. K. B. Brown, K. A. Allen, C. A. Blake, C. F. Coleman, D. J. Crouse, B. Weaver, and R. P. Wischow. Oct. 20, 1959. 48p. Contract [W-7405-eng-26]. OTS.

The recovery of U from amines by the high nitrate–water stripping method is described. The amine extraction of $Pu(NO_3)_3$ from $Al(NO_3)_3$ solutions containing HNO_3 is discussed. The extraction of $Pu(NO_3)_4$ from HNO_3 with phenylphosphonate esters was studied. The effect of salt type on rare earth extraction from nitrate solutions by neutral organophosphorus reagents was studied. Neptunium was recovered nearly completely from laboratory salvage by extraction with a primary amine from H_2SO_4. The recovery of fission product Sr from a synthetic Purex 1-WW solution was studied. (W.L.H.)

1581 CF-59-10-4
Oak Ridge National Lab., Tenn.
EUROCHEMIC ASSISTANCE: INFORMATION ON HAPO INSTRUMENTATION DEVELOPMENT. E. M. Shank. Oct. 5, 1959. 4p. Contract [W-7405-eng-26]. OTS.

Information on performance and availability of various instruments for Eurochemic are presented. Included are data on magnetic flowmeters, alpha printers, gamma monitor cells, gamma absorptiometer sources, electrodeless conductivity apparatus, and gamma scintillation monitor for I^{131}. (J.R.D.)

1582 HW-60928
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
TECHNOLOGY OF NON-PRODUCTION REACTOR FUELS REPROCESSING BUDGET ACTIVITY 2790. Quarterly Report. V. R. Cooper. July 2, 1959. Decl. Aug. 5, 1959. 20p. OTS.

Sawing studies were made using a dry friction blade for cutting Zircaloy tubing. An off-gas filtration system including a rotoclone and a filter assembly was installed to permit studying of the particulate material generated during the friction cutting operations. Studies of mechanical techniques for safety processing the Na or NaK alloy reservoirs present in some non-production fuels have continued. Stainless steel-clad swaged UO_2 rods and stainless steel-clad U–10 wt. % Mo alloy rods were sheared under water to investigate the mechanical and particulate handling problems associated with these two major components of the power reactor fuels reprocessing program. The behavior of explosive U–Zr residues in the Zirflex Process was studied. In dissolution of stainless steel cladding from UO_2 it was found that a more rapid initial UO_2 dissolution by H_2SO_4 occurred if the UO_2 was exposed to the atmosphere. Further studies on the dissolution of ingot U and sintered UO_2 in HNO_3 and HNO_3–ferric nitrate are reported. The dissolution of U–Mo alloys is being studied. The corrosion of 304-L stainless steel and Hastelloy-F in nitric acid–ferric nitrate systems was studied. Exploratory experiments were done attempting to define the effect of $Al(NO_3)_3$ and HF on the formation of explosion sensitive surfaces during the dissolution of U–low Zr alloys. Studies of metallic U dissolution in dilute aqua regia were made. Niflex (HNO_3–HF) dissolution studies of 304 stainless steel were continued. (W.L.H.)

1583 IDO-14493
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
ANALYTICAL PROGRAM FOR PROCESSING STAINLESS STEEL URANIUM DIOXIDE REACTOR FUEL ELEMENTS. G. A. Huff. Sept. 18, 1959. 22p. Contract AT(10-1)-205. OTS.

Analytical programs have been described for uranium recovery processes for aluminum-uranium and zirconium-uranium reactor fuel elements. It is the purpose of this paper to describe the analytical program for the uranium recovery process involving stainless steel-uranium reactor fuel elements. The recovery process consists of a two step dissolution and the regular liquid-liquid solvent extraction using TBP in kerosene. Sulfuric acid is used to dissolve the stainless steel. As a result of the sulfuric acid dissolution the uranium is converted to a slurry. The uranium slurry is then dissolved in nitric acid. After the nitric acid dissolution the feed material is compatible with the extraction columns used at the Idaho Chemical Processing Plant for other type fuel elements previously described. In order to analyze samples of dissolver solutions for constituents necessary for plant operation, three new analytical methods were developed. These methods are a rapid method for determining uranium, one for nitrate and one for sulfate. Methods are described for uranium, acidity, specific gravity, nitrate, and sulfate in the dissolver solution; also for small amounts of uranium in the extraction column raffinates. Samples of dissolver solution and first cycle aqueous raffinate contain large amounts of fission products. These samples require shielded facilities for analytical work. The remote analytical facility described by Dykes and his co-workers was used for this work. Precision and accuracy data are given for the analytical methods described. (auth)

1584 JEN-3
Spain. Junta de Energia Nuclear, Madrid.
SEPARACION DE NITRATO DE URANILO DE HIERRO(III), TITANO(IV) Y ALUMINIO(III) POR EXTRACCIÓN CON ETER. (Separation of the Uranyl Nitrates of Iron(III), Titanium(IV), and Aluminum(III) by Extraction with Ether). R. Fernandez Cellini and F. de la Cruz Castillo. 1956. 19p.

The theoretical and experimental data on the extraction of uranyl nitrate with ether, factors which affect the process, and analytical methods developed using this method are discussed. A modification to the extraction methods published is described and applied to the separation of uranyl nitrate from iron, titanium, and aluminum. The solvent partition of uranyl nitrate in the ether is determined. The method is applicable to the determination of uranium in minerals and other materials. (tr-auth)

1585 JEN-6
Spain. Junta de Energia Nuclear, Madrid.
ENSAYOS DE INTERCAMBIO ANIONICO CON RESINA AMBERLITA Ir-120. (Experiments on Anion Exchange with Amberlite Ir-120 Resin). R. Fernandez Cellini and J. Vera Palomino. 1956. 13p.

The ion exchange of the uranyl ion on Amberlite Ir-120 resin was studied with different uranyl ion concentrations. Elution with sulfuric acid was investigated and the elution curve for the experimental conditions was determined. From the concentrations of the ions of Cu^{2+}, Ni^{2+}, Fe^{3+}, Cd^{2+}, Mn^{2+}, and Cr^{3+} the maximum exchange capacity was tested and elution curves with 4 $\underline{N}$ sulfuric acid were obtained. (tr-auth)

1586 JEN-26
Spain. Junta de Energia Nuclear, Madrid.
EL EFECTO FINAL DE LA EXTRACCIÓN EN EL SISTEMA NITRATO DE URANILO-ETER DIETILICO-AGUA. I. FASE CONTINUA ACUOSA. (The Final Result of the Extraction in the Uranyl Nitrate–Diethyl Ether–Water System. I. Continuous Aqueous Phase). A. Perez Luiña, L. Gutierrez Jodra, and A. R. Miro. 1957. 9p.

The solute transfer of uranyl nitrate from diethylether to water was studied in a spray column using water as dispersed phase and a direction of extraction from ether to water. The column is 102 cm long and has a diameter of 4.7 cm. The entrances of the phases are 77 cm apart. The rates of flow of both phases were used as variables, and the concentration of the continuous phase was determined at different heights. The curves of the logarithm of the concentration of the continuous phase vs. distance to interphase show the presence of a drop of concentration in the entrance of the continuous phase. This depends on the rates of flow of the phases. No effect in the entrance of the dispersed phase was found. (auth)

1587

SOLVENT EXTRACTION WITH THE DI-ISOAMYL ESTER OF METHYL-PHOSPHINIC ACID. V. B. Shevchenko, I. G. Slepchenko, and V. S. Shmidt. Atomnaya Energ. 7, 236-43 (1959) Sept. (In Russian)

Solvent extraction of uranium with the di-isoamyl ester of methyl-phosphinic acid (DAMPA) is described. A high efficiency for extraction from nitric acid solutions is achieved. Certain regularities in extraction by DAMPA-hydrated kerosene systems are studied. The uranyl nitrate is extracted in the form $[UO_2(NO_3)_2\ (DAMPA)_2]$ with a stability constant 2540 ± 200; HNO_3 is extracted as HNP_3 DAMPA with a stability of 0.30 ± 0.03. (R.V.J.)

1588

THE INTERNAL CIRCULATION OF EXTRACTABLE MATERIALS IN TRIBUTYL. A. M. Rozen. Atomnaya Energ. 7, 277-81(1959) Sept. (In Russian)

The internal circulation of extractable materials was studied by plotting HNO_3 γ-x diagrams with individual curves for uranyl nitrate acid. Distributions of the concentrate along the column and the extraction with flushing and reduction partition are determined. An additional circulation by flushing places extraction at its maximum; the flux phase ratio $n_o = V/L_o$ is increased in comparison to extraction without flushing $n_o = f(n : n)$. The U and Pu reduction partition column was studied at large flux ratios $(n > 10)$. A sharp use in acid concentration purges uranium, inducing internal circulation of uranyl nitrate. (R.V.J.)

1589

SCALE-UP OF MIXER-SETTLERS. A. D. Ryon, F. L. Daley, and R. S. Lowrie (Oak Ridge National Lab., Tenn.). Chem. Eng. Progr. 55, No. 10, 70-5(1959) Oct.

The rate of uranium extraction in the Dapex process is proportional to the cube root of power input for both batch and continuous flow if the extraction in the mixer only is measured. Mixers can be scaled-up by geometric similitude at constant power input per unit mixer volume, demonstrated in 6-, 12-, 20-, and 36-in. diam. mixers, representing a volumetric scale-up ratio of 200 to 1. The flow capacity of settlers is characterized by a band of dispersion at the interface, the thickness of which is a measure of the approach to flooding. Settlers can be scaled-up based on flow rate per unit cross-sectional area, demonstrated in settlers 6 in. to 16 ft. diam., representing an area scale-up ratio of 1000 to 1. Control of mixing to form water-in-oil dispersions is recommended to minimize solvent entrainment and emulsions with solutions containing colloidal material which stabilize oil-in-water emulsions. (auth)

1590

ISOTOPE SEPARATION BY ION EXCHANGE. E. Glueckauf (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Am. Chem. Soc. 81, 5262-3(1959) Oct. 5.

The close analogy between ion exchange resins and concentrated aqueous solution is demonstrated by the equilibrium between a dilute and concentrated aqueous solutions of corresponding to that of the exchangers concerned. Supporting examples and data are given and it is noted that if this principle applies generally, the outlook for enriching isotopes of higher mass by pure ion exchange is dim. (J.R.D.)

1591

SEPARATION OF YTTRIUM AND RARE-EARTH NITRATES WITH THE SOLVENT EXTRACTION SYSTEM-TRI-N-BUTYLAMINE-3 METHYL-2-BUTANONE. W. G. Gruzensky and G. T. Engel (U. S. Bureau of Mines, Albany, Ore.). Trans. Met. Soc. AIME 215, 738-42(1959) Oct.

The application of tri-n-butylamine as an extractant in separating yttrium-rare earth mixtures by liquid-liquid extraction is described. The method of opening the ore is related, followed by a description of the preliminary separation of the composite into groups. The different variables in an amine-ketone-yttrium-rare earth-nitrate system were studied. (auth)

1592

SALTING OUT OF BINARY NIOBIUM SULFATE BY AMMONIUM SULFATE FROM SULFURIC ACID IN PRESENCE OF TANTALUM AND TITANIUM. Ya. G. Goroshchenko, M. I. Andreeva, and A. G. Babkin. Zhur. Priklad. Khim. 32, 1664-70(1959) Aug. (In Russian)

It is found that zinc amalgam reduces niobium to a mean valence of 3.2 to 3.6, titanium to Ti^{3+}, and tantalum to $Ta^{4.4+}$. The zinc amalgam niobium recovery can be used for niobium precipitation from sulfuric acid solutions in the form of $3(NH_4)SO_4 \cdot (NbO_2)(SO_4)_3 \cdot 2Nb_2(SO_4)_3$ in the presence of tantalum and titanium. The niobium precipitation in the salt form is recommended for obtaining 98 to 99% pure niobium pentoxide from titanium–niobium concentrates and their intermediate products. (R.V.J.)

1593

IMPROVEMENTS IN OR RELATING TO A PROCESS FOR THE TREATMENT OF NUCLEAR FUEL. Geoffrey John Ashworth, Peter George Minchin Brown, John Molyneaux Fletcher, and Arthur Gregory Wain (to United Kingdom Atomic Energy Authority). British Patent 822,290. Oct. 21, 1959.

A modification of a breeder reactor fuel treatment process is offered which gives improved Ru decontamination. In one process the fuel is dissolved in HNO_3, the pH is then adjusted, and the solution is extracted with TBP. Ru present in nitrosyl from before extraction is converted to the nitro form by addition of HNO_2 according to the modification. The nitro form extracts less easily thereby resulting in better decontamination. (T.R.H.)

ENGINEERING AND EQUIPMENT

General and Miscellaneous

1594 NP-8034

Shell Development Co., Emeryville, Calif.

FUNDAMENTALS OF HIGH TEMPERATURE BEARING LUBRICATION. Bimonthly Report No. 5, September–October 1958. J. B. Accinelli and S. J. Beaubien. 18p. Contract NOas 58-278-d. (S-13766).

Work on the high-temperature high-speed performance of M-10 tool steel bearings equipped with an S-monel separator is reported. With mineral oil as the lubricant, this bearing (20 mm size) appears to be superior to the stainless-bronze or stainless-S-monel bearing used to date in these studies, especially at very high speeds (60,000 rpm) and temperatures above 800°F. Its friction limited temperature is higher and its ball separator wear is significantly lower. However, for long term operation at very high speeds and temperature, fatigue may be a problem with this bearing. Studies of the mechanism by which increased lubricant flow rate improved very high speed performance are as yet inconclusive. There is definite evidence that a critical flow exists for different speeds and different temperature levels, and some indication that cooling of the contact zone by the lubricant may be a factor. Deterioration of mineral oil and bearing deposits are very small even at extremely high temperatures (1000°F) if residence time of the lubricant in the hot zone is very short. (auth)

1595 NP-8036
New York Univ., New York. Coll. of Engineering.
DEVELOPMENT OF IMPROVED TITANIUM ORGANIC COMPOUNDS FOR USE AS HYDRAULIC FLUIDS. Technical Report No. 1 Covering the Period July 1—August 31, 1959. Sept. 15, 1959. 62p. Contract NOas-60-6011-c.

Development of organo-titanate compounds was continued, aimed at viscosity index improvement, pour point lowering, high-temperature resistance extension, and hydrolytic stability achievement. Toward this goal hydrogenation and solvent separations were studied for compound purification, and a search for corresponding compounds containing stronger bonding than those found in the isopropyl titanate compounds was conducted. (auth)

1596 NYO-7565
Pennsylvania State Univ., University Park.
STRESSES IN CONTOURED NOZZLES WHEN SUBJECTED TO EXTERNAL LOADINGS. Period [covered]: October 16, 1958 to September 15, 1959. D. E. Hardenbergh. Sept. 15, 1959. 85p. Contract AT(30-1)-1874. OTS.

The states of stress in the vicinity of four hot-formed contour-type nozzles were determined when various external loadings were individually applied at the extremity of the branch pipes. The types of loadings that were imposed upon the nozzles were axial thrust, torsion, longitudinal bending, and transverse bending. The nozzles are the same ones that were previously tested under internal pressure. (auth)

1597 SCTM-299-59(51)
Sandia Corp., Albuquerque, N. Mex.
RESULTS OF A FORCE TEST OF FOUR CONFIGURATIONS OF THE HI-LO INSTRUMENTED AND CHAFF ROCKETS IN THE SANDIA CORPORATION 12 × 12 INCH TRANSONIC WIND TUNNEL (PROGRAM III-46). J. W. Arnold. Sept. 24, 1959. 56p. OTS.

Wind-tunnel testing of the Hi-Lo Test Vehicle was conducted through the transonic and supersonic Mach number ranges in a 12 × 12 in. transonic facility and a 20-in. supersonic wind tunnel. Complete results of the tests in the transonic range are presented. A short correlation study of the data obtained in both wind tunnels is also made. All configurations were statically stable throughout the Mach number range. The static stability of all configurations is lowest at the supersonic Mach numbers. Comparison of the 12-in. transonic tunnel force and stability data with the supersonic data indicates excellent correlation. (auth)

1598
THE ART AND SCIENCE OF ENCAPSULATION. John H. Stang and Eugene M. Simons (Battelle Memorial Inst., Columbus, Ohio). Battelle Tech. Rev. 8, 8p(1959) Aug.

A review is presented of the irradiation capsule design in which skill in engineering and physics must be combined to cope with problems involving heat transfer, stress analysis, mechanical design, instrumentation, radiation field characteristics, and resistance to corrosion by reactor coolant and to radiation damage. The evaluation of a typical irradiation capsule is shown. (J.E.D.)

1599
EFFECT OF A UNIFORM MAGNETIC FIELD ON THE NATURAL VIBRATIONS OF MECHANICAL SYSTEMS. R. A. Mozniker (Inst. of Building Machines, Academy of Sciences, Ukrainian SSR). Dopovidi Akad. Nauk Ukr. R.S.R. No. 8, 847-52(1959). (In Ukrainian)

An investigation of the effect of a uniform magnetic field on the natural vibrations of mechanical systems has shown it to be quite significant in a number of cases. Simple formulas were developed for the determination of the natural frequency, taking into consideration the effect of the magnetic field. Experimental results are in good agreement with the results obtained in this study. (auth)

1600
LEAK DETECTION ON VESSELS UNDER PRESSURE BY MEANS OF A HELIUM SPECTROMETER. R. Geller (Commissariat à l'Énergie Atomique, Paris). Vide 71, 398-406(1957) Sept.-Oct. (In French)

Two methods, using a helium spectrometer, for the detection of leaks in vessels operating under high pressure are described. The first method which uses a "snifer" is for vessels into which helium can be introduced through some aperture. The second method is designed for sealed vessels. In the first method the helium escaping from the vessel is detected spectrometrically and in the second the helium forced through the leak into the vessel under pressure is determined. (J.S.R.)

1601
IZOTOPY; CZTERY ODCZYTY O ZASTOSOWANIACH. (Isotopes: Four Lectures on Their Application). Jan Mergentaler, ed. Wrocław, Poland, Panstwowe Wydawnistwo Naukowe, 1957, 73p.

A collection of articles representing a series of lectures delivered at the Conference on the Use of Isotopes in Science and Technology is presented. The conference was held at the Politechnika Wrocławska (Wrocław Polytechnic Institute), Nov. 5, 1955. The text of the four lectures is given in this volume. The discussions which followed these lectures are not given. No references are given. (TCO)

1602
RADIOISOTOPES FOR INDUSTRY. Robert S. Rochlin and Warner W. Schultz. New York, Reinhold Publishing Corporation, 1959. 197p.

Applications of radioisotopes in industrial research, manufacturing, testing, and process control are reviewed. More than 1700 industrial firms in the United States are using radioisotopes in a wide variety of ways. A number of these applications are described briefly. (C.H.)

Heat Transfer and Fluid Flow

1603 AECU-4388
General Electric Co. General Engineering Lab., Schenectady, N. Y.
AN EXPERIMENTAL EVALUATION OF THE EFFECT OF LENGTH-TO-WIDTH RATIO ON THE CRITICAL FLOW VELOCITY OF SINGLE PLATE ASSEMBLIES. W. L. Zabriskie. Sept. 1, 1959. 60p. (59-GL-209). OTS.

Single plates with length-to-width ratios varying from five to thirty were tested over a flow range near and above the critical velocity. Data from impact pressure readings at the channel exit are compared with static pressure differential along the plate axis. It was found that allowable plate deflection, rather than critical velocity to cause collapse, is the limiting criterion. Static pressure taps in the side plates were used to show magnitude and axial locations of deflections. No conclusive results were obtained with plexiglas plates because uncertainty in interpretation of impact pressure readings and lack of reliable data on the effects of water absorption data are presented graphically and diagrams and photographs are included. (J.R.D.)

1604 AFOSR-TN-59-977

Naples. Università. Istituto di Aeronautica.

LAMINAR MIXING OF STREAMS OF DIFFERENT GASES. Technical Note No. 1. Luigi G. Napolitano and A. Pozzi. Apr. 1959. 75p. Contract AF61(052)-160. (IA-10).

Solutions of plane, isobaric, and laminar mixing of two streams of different gases are presented. For the case of isovel mixing an exact, closed form solution is derived for the general case of Lewis number (Le) different from one. With the help of this exact solution it is shown that the assumption Le = 1 may lead to substantial errors in the temperature profiles which are already of the order of 10% when the Lewis numbers of the two streams are around 1.10 + 1.20. An approximate method of solution, based on the integral method, is presented for the general case without the limitations of constant Schmidt number and constant ($\rho\mu$). The solution by this method proves to be simple and immediate. The accuracy of the method is determined by comparison with the previously mentioned closed-form solution and with numerical solutions obtained by means of a high-speed computing machine for a number of indicative cases. The comparison shows that velocity profiles and concentration profiles are accurate to within few percent throughout the ranges of practical interest of the parameters entering the problem. The maximum errors (of the order of 3 to 4% and 8 to 10% for velocity and concentration profiles respectively) were found to occur for very low values of the ratios of the molecular weights and of the velocities of the two free streams. An evaluation of the errors introduced by the often made assumption $\rho\mu$ = const is also performed. It appears that the size of the errors depends on the value of the parameters $\chi = \mu_2 m_2/\mu_1 m_1$ and on the velocity ratio u_{21}. The errors become as large as about 50% for $u_{21} = 0.2$ and $\chi = 0.033$. (auth)

1605 NAA-SR-Memo-4160

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

SURVEY OF THE LITERATURE PERTAINING TO THE PHENOMENA OF NUCLEATE BOILING. R. A. Rockow. Aug. 14, 1959. 27p. OTS.

A literature survey is presented to consolidate and summarize the information presently available in the area of nucleate boiling heat transfer. Effort was employed to present as much information about organic boiling heat transfer characteristics as presently available. (auth)

1606 NP-7996

Space Technology Labs., Inc. Physical Research Lab., Los Angeles.

ON ONE-DIMENSIONAL CHANNEL FLOW IN THE PRESENCE OF A MAGNETIC FIELD. William B. Bush. May 4, 1959. 20p. Contract AF04(647)-309.

The differential equations for the one-dimensional varying-area channel flow of a perfect gas in the presence of a magnetic field are formulated under the restriction that the electric field be zero. The integration of the equations is performed for cases in which the quantity $Q = [\sigma B_y^2/\rho\ (du/dx)]$ is a constant, and in which the velocity is a known function of the distance, the component of the magnetic field normal to the flow is an arbitrary function of the distance, and the electrical conductivity is dependent on temperature alone. The solutions are presented in analytical and graphical form. The results show that with increasing magnetic field the sonic point moves downstream from the channel's throat and that, in general, a larger exit area is needed to obtain a given supersonic flow Mach number. The solution of the second case for velocity gradient, normal component of magnetic field, and electrical conductivity, all constant, indicates that, for a strong enough magnetic field, even if the exit area approaches infinity, everywhere in the channel the flow remains subsonic. (auth)

1607 NP-7997

Space Technology Labs., Inc. Physical Research Lab., Los Angeles.

RATE OF HEAT-TRANSFER NEAR THE STAGNATION POINT OF A BLUNT BODY OF REVOLUTION, IN THE PRESENCE OF A MAGNETIC FIELD. Rudolf X. Meyer. Mar. 14, 1958. 61p. Contract AF04(647)-127. (GM-TR-0127-00016).

A similarity solution for the two-dimensional, viscous stagnation-point flow in the presence of a magnetic field is extended to the rotationally symmetric case. Also, as a further extension, Joule heating and the heat generated by viscous dissipation are taken into account. A new formulation for the boundary conditions is found, in a manner which permits an exact solution to be determined in terms of ordinary differential equations, which in turn are integrated numerically. Typical orders of magnitude of the parameters are then discussed for the case of atmosphere re-entry. It is found that these orders of magnitude are such that a boundary layer approximation of the magnetohydrodynamic problem can be made, and is necessary for obtaining meaningful numerical results. The singular perturbation corresponding to this approximation is carried out and the Nusselt number characterizing the rate of heat-transfer to the body is computed as a function of the magnetic field strength. (auth)

1608 ORNL-1330

Oak Ridge National Lab., Tenn.

HEAT EXCHANGER DESIGN CHARTS. A. P. Fraas and M. E. LaVerne. Dec. 7, 1952. Decl. Oct. 9, 1959. 82p. Contract W-7405-eng-26. OTS.

Several design charts of the ORNL-ANP liquid-to-liquid heat exchanger are given along with brief explanations and sample calculations. Pictures of the models that have been built are given as an introduction to the type of heat-exchanger construction. Fluid flow and pressure losses are discussed, and the heat-transfer coefficients are calculated from physical-property data of the fluids. Finally, a series of charts was prepared to show the performance characteristics of some typical counterflow heat exchangers as an aid in the rapid determination of effects of changes in design conditions. (J.E.D.)

1609 AEC-tr-3868

SOME RELATIONSHIPS IN HEAT TRANSFER TO BOILING MERCURY IN FORCED CONVECTION. M. A. Styrikovich and I. E. Semenovker. Translated for Atomics International from Zhur. Tekh. Fiz. 10, 1331-9(1940). 21p. JCL or LC.

The heat transfer to boiling Hg was studied in forced convection flow. (W.L.H.)

1610

THE EFFECT OF AN INTERNAL HEAT SOURCE ON THE HEAT TRANSFER COEFFICIENT. S. S. Kutateladze, N. I.

Ivashchenko, T. V. Zablotskaya. Atomnaya Energ. 7, 253-4 (1959) Sept. (In Russian)

The influence of an internal heat source on the heat transfer coefficient is considered for the case where a liquid flows through a cylindrical tube, the effect of the entrance region is negligible. (R.V.J.)

1611

HEAT TRANSFER OF MOLTEN SODIUMFLOWING TRANSVERSELY ACROSS A SINGLE CYLINDER. A. A. Andreevskií. Atomnaya Energ. 7, 254-6(1959) Sept. (In Russian)

The local heat transfer dependence on the flow rate, the distribution of heat transfer along a cylinder, and variations of the relative heat transfer coefficient across the cylinder are analyzed. The mean heat transfer in transverse flow across cylinders and tube systems is plotted. (R.V.J.)

1612

EXTRACTION OF A HEAT FLUX AT UNIFORM DENSITY BY FORCED CONVECTION OF A FLUID FLOWING AGAINST AN ISOTHERMAL SHELL. Bull. inform. sci. et tech. (Paris) No. 31, 111-13(1959) July-Aug. (In French)

A fluid is considered, flowing between two isothermal shells and forming a thin layer of thickness constant transversally, but slowly variable in the direction of flow. (T.R.H.)

1613

FORCED CONVECTION IN A CIRCULAR TUBE COOLED BY FLOWING AIR. STUDY OF HEAT TRANSFER BY TURBULENCE. Bull. inform. sci. et tech. (Paris) No. 31, 114-17(1959) July-Aug. (In French)

In connection with heat transfer studies with logitudinally finned fuel elements, an investigation was conducted of forced convection on a simple geometric configuration: a circular heating tube cooled by air at atmospheric pressure. The object of the study was demonstration of the relation of turbulent friction and turbulent conductivity by observing speed and temperature and making use of experimental results particularly convenient. This consisted in representing temperature as a function of velocity. (T.R.H.)

1614

NOVEL METHOD FOR DETERMINING NUCLEATE BOILING SITES. R. F. Gaertner and J. W. Westwater (Univ. of Illinois, Urbana). Chem. Eng. Progr. 55, No. 10, 58-61 (1959) Oct.

To measure the number of active bubble-producing sites in a boiling liquid, a method of simultaneous electroplating during boiling was developed which successfully permitted counts of active sites as dense as 1130/sq. in. at 317,000 Btu/hr. per sq. ft. A random geometrical distribution of active sites was revealed by a photographic study of a nickel-plated heated surface (auth)

1615

CALCULATION OF THE FILTRATION DISCHARGE FROM CHANNELS OF ARBITRARY CROSS SECTION. P. A. Rudchenko (Kiev Civil Engineering Inst.). Dopovidi Akad. Nauk Ukr. R.S.R. No. 8, 853-7(1959). (In Ukrainian)

Two new formulas are derived for determining the filtration discharge from a rectangular channel of infinite length, which permit determination of the filtration discharge with an accuracy up to 0.5%. Two formulas are also given for determining the λ parameter. The application of the successive conformal mappings method to the solution of the problem of filtration from a channel of arbitrary cross section in the case of a finite depth of bedding of the draining layer is discussed. New approximate formulas were also derived for determining the filtration discharge from a rectangular channel with finite depth of the draining layer. (auth)

1616

DYNAMIC RESPONSE OF HEAT EXCHANGERS HAVING INTERNAL HEAT SOURCES. PART III. Vedat S. Arpaci (Istanbul Technical Univ.) and John A. Clark (Univ. of Michigan, Ann Arbor). J. Heat Transfer 81, 253-66(1959) Nov.

The dynamic response of the temperature of the heat-transfer surface and the fluid-surface temperature difference in a heat exchanger having internal heat sources is presented. A general solution is presented for a transient resulting from an arbitrary time rate of change of heat generation starting from an arbitrary initial condition. The results are obtained by a direct mathematical attack on the governing differential equations. As a special case, the transient resulting from a linear time rate of change of internal heat generation is given, and this is compared with both experimental and theoretical results corresponding to a step change in heat generation. Satisfactory comparison is obtained. The results for this special case are presented such that the surface temperature and fluid surface temperature difference may be computed as a function of space and time using four dimensionless, mathematical functions which are given in graphical form. It is shown how the case of the linear time rate of change of internal heat generation may be used to compute the dynamic response of this type of heat exchanger for any transient resulting from excursions in heat-generation rate which may be approximated piecewise by a series of linear functions of time. Heat exchangers to which these solutions apply include the heterogeneous nuclear reactor. (auth)

1617

HEATING AND COOLING AIR AND CARBON DIOXIDE IN THE THERMAL ENTRANCE REGION OF A CIRCULAR DUCT WITH LARGE GAS TO WALL TEMPERATURE DIFFERENCES. Helmut Wolf (Rocketdyne Div., North American Aviation, Inc., Canoga Park, Calif.). J. Heat Transfer 81, 267-79(1959) Nov.

The local heat-transfer characteristics for air and carbon dioxide in the thermal entrance region have been determined experimentally and are compared with predicted values computed from an extension of the theoretical analysis due to Deissler. The experiments were conducted in smooth round tubes having a fully developed turbulent velocity profile and a uniform temperature distribution at the entrance. The boundary conditions of uniform heat flux for heating the gas, and wall temperature constant and variable with axial distance for cooling the gas, were investigated with large temperature differences between the gas and the tube wall. For heating, the experimental results yielded one per cent thermal entrance lengths ranging from 11 to 27 diameters over the bulk Reynolds number range from 50,000 to 246,000. For cooling, one per cent thermal entrance lengths ranging from 12 to 26 diameters were obtained for bulk Reynolds numbers ranging from 17,000 to 218,000. The agreement between theory and experiment was favorable in most cases. (auth)

1618

TURBULENT FLOW IN A CIRCULAR TUBE WITH ARBITRARY INTERNAL HEAT SOURCES AND WALL HEAT TRANSFER. R. Siegel and E. M. Sparrow (Lewis Research Center, Cleveland). J. Heat Transfer 81, 280-90(1959) Nov.

An analysis has been carried out to determine the heat-transfer characteristics for turbulent flow of a heat generating fluid in a circular tube with wall heat transfer. The internal heat generation is uniform over the tube cross section, but may vary longitudinally in an arbitrary manner. The wall heat transfer may also vary in an arbitrary way in the longitudinal direction. The analysis applies along the entire length of the tube, that is, in thermal entrance as well as fully developed regions. The fluid is assumed to have a fully developed turbulent velocity profile throughout the length of the pipe. Numerical results are presented for fluids with Prandtl numbers ranging from 0.7 to 100 for Reynolds numbers from 50,000 to 500,000. The extension of the results to include radial heat source variations is indicated. (auth)

1619
LAMINAR CONDENSATION HEAT TRANSFER ON A HORIZONTAL CYLINDER. E. M. Sparrow and J. L. Gregg (Lewis Research Center, Cleveland). J. Heat Transfer 81, 291-6(1959) Nov.

A boundary-layer analysis is made for laminar film condensation on a horizontal cylinder. The formulation includes both the inertia forces and energy convection terms, which are neglected in Nusselt's simple theory. A similarity transformation, valid over most of the cylinder, is found which reduces the partial differential equations of the problem (the conservation laws) to ordinary differential equations. Numerical solutions of the resulting ordinary differential equations are available for the Prandtl number range from 0.003 to 100. Heat-transfer results are presented and discussed. (auth)

1620
THERMODYNAMIC PROPERTIES OF HELIUM AT LOW TEMPERATURES AND HIGH PRESSURES. D. B. Mann (National Bureau of Standards, Boulder, Colo.) and R. B. Stewart (Univ. of Colorado, Boulder). J. Heat Transfer 81, 323-6(1959) Nov.

The thermodynamic properties of helium have been compiled and correlated for a temperature range from 3.0 to 20°K for pressures to 100 atmospheres and for specific volumes from 5 to 800 liters per kilogram. The properties are presented on both the temperature-entropy and the enthalpy-entropy co-ordinate systems and include pressure, temperature, volume, entropy, and enthalpy. (auth)

1621
RADIATION FIN EFFICIENCY FOR ONE-DIMENSIONAL HEAT FLOW IN A CIRCULAR FIN. R. L. Chambers (Westinghouse Electric Corp., East Pittsburgh, Penna.) and E. V. Somers (Westinghouse Electric Corp., Pittsburgh). J. Heat Transfer 81, 327-9(1959) Nov.

The equations governing the temperature distribution and fin efficiencies for a nonlinear heat transfer and curves relating the fin efficiency to the dimensionless independent variables are presented. A comparison of the fin efficiencies for convective linear heat transfer data with those calculated for non linear radiation heat transfer is given. (J.E.D.)

1622
LAMINAR FLOW IN THE ENTRANCE REGION OF A POROUS PIPE. Harold L. Weissberg (Oak Ridge Gaseous Diffusion Plant, Tenn.). Phys. Fluids 2, 510-16(1959) Sept.-Oct.

The equation of motion for steady, incompressible, axially symmetric flow in a pipe with uniform wall suction or injection is expressed in terms of a "dimensionless stream function," $F(\zeta, \eta) = \psi(x, r)/\psi(x, a)$, where ψ is the usual stream function, x and r are cylindrical polar coordinates, a is the radius of the pipe, $\zeta = 1 - [2Rx/(aN)]$, $\eta = (r/a)^2$. R and N are Reynolds numbers which specify the flows through the pipe wall and through the inlet, respectively. This equation, which includes as a special case the equation previously obtained by Yuan and Finkelstein for similar (affine) velocity profiles, is greatly simplified by passing to the limit which is approached as N increases. Nonsimilar, ζ-dependent solutions are approximated by a generalization of the method applied by Morduchow to the ζ-independent equation of Yuan and Finkelstein. The results show the manner in which the condition of similarity of the velocity profiles is approached for a prescribed (e.g., parabolic) inlet profile. They also indicate the development of reverse flow at the wall of the pipe in the range of R values for which no similar solutions exist. (auth)

1623
ON A CLASS OF COMPRESSIBLE LAMINAR BOUNDARY LAYERS WITH PRESSURE GRADIENT FOR AN ELECTRICALLY CONDUCTING FLUID IN THE PRESENCE OF A MAGNETIC FIELD. Paul S. Lykoudis (Purdue Univ., Lafayette, Ind.). p. 168-80 of "IXth International Astronautical Congress, Amsterdam, 1958, Proceedings. [Vol.] I." F. Hecht, ed. Vienna, Springer-Verlag, 1959. p.1-506.

The general problem of the laminar boundary layer of a viscous, compressible, heat and electrically conducting fluid in the presence of a magnetic field fixed relative to the moving body, with an acting pressure gradient is discussed. It is shown that general similarity solutions for the equations of motion and energy do exist under certain assumptions. Velocity and enthalpy profiles are calculated for different wedge type geometries and different values of the ratio of the square of Hartmann's number to the kinematic Reynolds number. Solutions for boundary conditions assimilating combustion, blowing, or sublimation at the wall are also presented. The problem of "stagnation flow" is discussed in detail and the heat transfer coefficient which includes the effects of the imposed magnetic field and dissociation is compared with heat transfer coefficients which do not consider these effects. The catalytic recombination rates at the wall are taken into account; it is shown that the presence of the magnetic field gives rise to an unfavourable contribution to the heat transfer rate through the catalytic factor that enters the calculations. (auth)

Instrumentation

1624 AERE-M-461
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
LARGE AREA SCINTILLATION DETECTOR FOR SLOW NEUTRON TIME-OF-FLIGHT STUDIES. J. F. Raffle and J. W. Hall. July 1959. 19p. BIS.

The development of a large-area scintillation detector using boron-loaded phosphors in conjunction with a matrix of photomultipliers is described. The detector is based on the reaction $B^{10}(n,\alpha)Li^7$, and in order to achieve high efficiencies in a short length, a solid boron compound in conjunction with zinc sulfide was used. It was found that the zinc sulfide-boron oxide system offered greater advantages, and the detector system was based on this phosphor. (J.E.D.)

1625 AFCRC-TN-59-890
Stanford Univ., Calif. Microwave Lab.
A PROPOSED MILLIMETER-WAVE GENERATOR. G. S. Kino. Sept. 1959. 20p. Project No. 47501. Contract AF49(638)-415. (ML-606).

A millimeter-wave generator, using a waveguide filled with a plasma of uniform cross-sectional density, but with an axial density variation of the form $\rho_0(1 + \alpha \sin \gamma z)$, is discussed. It is shown, by solving the wave equation for the system, that slow-wave space harmonics of the normal waveguide mode are set up which can interact with an electron beam. These space harmonics, although usually of small amplitude, can have the property that their electric fields are maximum at the center of the guide and minimum at its walls. The design of a 1-mm backward-wave oscillator operating at 2.5 kv with approximately 12 ma starting current is dealt with. This design is postulated on the assumption that the so-called Langmuir electrostatic sound waves or similar modes may be used to set up the necessary density variation in the plasma. (auth)

1626 AFOSR-TN-59-501
New York Univ., New York. Coll. of Engineering.
A STUDY OF DEAD TIME AND RESOLVING TIME IN A PROPORTIONAL COUNTER. William Reidy. Jan. 1959. 43p. Contract AF18(600)-1555. (AD-215926).

Measurements were made on a helium isobutane counter, which determined the variation of dead time and resolving time with voltage and pulse amplitude. The purpose of this investigation was to determine the dead time and resolving time of the counter when operated in the proportional region and contrast this with operation in the geiger region. Results were obtained from photographs and direct measurements of the counter pulse as displayed on an oscilloscope. The dead time in the proportional region was observed as less than one microsecond, while in the geiger region, it is of the order of several hundred microseconds. In addition, measurements were made by the two-source method to determine the resolving time of a proportional counter and its associated electronic counting system. These measurements gave results of the order of five microseconds. (auth)

1627 ARF-1151-2
Illinois Inst. of Tech., Chicago. Armour Research Foundation.
MAGNETIC RECORDER FOR NUCLEAR PULSE APPLICATION. Covering Period: August 6, 1959 to October 5, 1959. G. M. Burgwald and C. A. Stone. 27p. Contract AT(11-1)-702. OTS.

Direct recording of nuclear pulse height data on magnetic tape is being investigated. The characteristics of various brands of commercial tape are being investigated and a waveform analysis is being performed in an attempt to determine the most favorable frequency range for available tapes. Use of the magnetic modulator head is being investigated to minimize variations due to short term tape speed variations. (W.L.H.)

1628 CREL-828
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
TRANSISTORIZED PULSE AMPLIFIERS. 3. A TRANSISTOR AMPLIFIER FOR USE WITH METHANE PROPORTIONAL COUNTERS. J. B. S. Waugh. Sept. 1959. 32p. (AECL-886). AECL.

For presentation at the Canadian Convention of the Institute of Radio Engineers, Toronto, Ontario, October 7-9, 1959.

A transistor pulse amplifier for use with methane proportional counters is described. The counter operation and the characteristics of the electrical output signals are described. Voltage and current pulse waveforms are related, and the use of the short duration current pulse to obtain a smaller resolving time amplifier is pointed out. The practical amplifier uses low input impedance current amplifying stages throughout. The individual stages are described in detail. Plateaus obtained from an Sr^{90} source in a 4π flow counter show slopes of less than 0.15% per 100v over a range of more than 300v at counting rates up to more than 34×10^3 per sec. The estimated minimum detectable input pulse corresponds to about 20 ion pairs with this system. The amplifier physical construction employing printed plug-in cards is described in detail and illustrated. A vacuum tube preamplifier is described which enables the detection of pulses arising from the formation of 2 to 3 ion pairs. (auth)

1629 CREL-830
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
TRANSISTORIZED PULSE AMPLIFIERS. 2. THE TRANSISTOR FEEDBACK-PAIR; PREDICTION AND MEASUREMENT OF THE PARAMETERS OF AN AMPLIFIER EMPLOYING 2N247 TRANSISTORS. J. B. S. Waugh and R. W. Nicholson. Sept. 1959. 46p. (AECL-885). AECL.

The prediction and measurement of the small signal frequency dependent parameters of a feedback pair employing 2N247 drift transistors are reported. The matrix method of circuit analysis is used and the computations carried out by digital computer. The precise measurement of the amplifier transfer function and input impedance over a wide frequency range is described. The method determined the two-port admittance parameters of the amplifier using a three terminal radio frequency bridge. Calculated and measured values of gain and input impedance are presented. Agreement in gain was ±1 db out to 10 times the amplifier 3 db cut-off frequency. The values of input admittance are in reasonable agreement over the same frequency range. (auth)

1630 HW-51442(Rev. 1)
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
PANELLIT GAUGE MANUAL PRESSURE MONITOR. PANELLIT GAUGE MODELS: 152-B-D-DR-F-H; 151-KE-KW; 151-C. Apr. 15, 1959. Revised Aug. 15, 1959. 35p. Contract W-31-109-Eng-52. OTS.

A standard manual for use by personnel concerned with Panellit gage maintenance and parts procurement is presented. Master drawings and assembly drawings are included along with part number listings. (J.R.D.)

1631 HW-54886(Rev.1)
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
BETA FIELD DOSE RATE DETERMINATION FOR ANGULAR RESPONSE WITH THE JUNO DOSE RATE METER. J. F. Evans. Oct. 15, 1959. 16p. Contract AT(45-1)-1350. OTS.

The response of radiation detection instruments utilizing an ionization chamber to beta sources placed in various counter-source positions is discussed. Results are reported from an evaluation of the Juno dose rate meter for an extended source. The magnitude and characteristics of correction factors were measured. An experimental method is described for beta field dose rate determinations with dose rate meters. Data taken and analyzed in accordance with this method are included and discussed. (C.H.)

1632 HW-59612
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
A SCINTILLATION NUCLEAR INCIDENT ALARM MONITOR. W. G. Spear. Mar. 13, 1959. 13p. Contract W-31-109-Eng-52. OTS.

The design of a scintillation nuclear incident alarming instrument which can be reliably set to alarm in any gamma field intensity from one mr/hr to greater than ten r/hr is described. An inexpensive high-voltage supply, an inexpensive terphenyl-in-polyvinyltoluene crystal, a multiplier phototube, and a meter relay are the basic components. An addenda two-transistor booster amplifier can be used if necessary for very low-level triggering. The amplifier has a gain of approximately ten. The same instrument, with only a change in crystals to a boron zinc-sulfide crystal, can be used for fast or slow neutron alarming. Beta alarming can be included by supplying the crystal detector with an aluminized mylar light cover. Two such units can be operated in a dual or back-to-back fashion. Such operation requires both unit relays to close before activation of the main alarm relay. (auth)

1633 HW-61163

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
AN IMPROVED VERNIER CHRONOTRON. J. T. Russell. July 20, 1959. 22p. Contract AT(45-1)-1350. OTS.

The instrument described is a multichannel time-interval analyzer with digital output for use in the nanosecond (10^{-9} sec) region. The improved version has much greater channel width stability. Time resolution of a complete time-of-flight system is about 6×10^{-10} seconds. Several design changes were made to improve linearity and reliability. (auth)

1634 JEN-29

Spain. Junta de Energia Nuclear, Madrid.
CALIBRADO DE ESPECTRÓMETROS GAMMA DE CENTELLEO CON LOS RAYOS GAMMA DEL Ra Y DEL Mn^{56}. (Calibration of Scintillation Gamma Spectrometers with the Gamma Rays from Ra and Mn^{56}). M. García Muñoz and D. Maeder. 1957. 10p.

The use of the gamma radiation from Ra and Mn^{56} for the calibration of scintillation spectrometers in the energy range from 1.4 to 2.8 Mev was investigated. The gamma spectrum of radium was remeasured in a pulse spectrometer and compared with very accurately known energies of Cs^{137}, Co^{60}, and Na^{24}. The comparison of the results with the scintillation lines to be expected on the basis of measurements with magnetic spectrometers shows that radium can be used in the 2 Mev calibration with an accuracy of ±1%. The energy of the three gamma rays of Mn^{56} was measured by the same method, and good agreement was obtained with the measurements made with a magnetic spectrometer. (J.S.R.)

1635 LAMS-2257

Los Alamos Scientific Lab., N. Mex.
PRELIMINARY INVESTIGATION OF A FIVE-CRYSTAL SCINTILLATION GAMMA-RAY SPECTROMETER. Roger E. Mills and Robert M. Kloepper. Sept. 1958. 35p. Contract W-7405-eng-36. OTS.

A five-crystal scintillation gamma-ray spectrometer was constructed for use as a Compton coincidence spectrometer or as a pair coincidence spectrometer. Preliminary tests are discussed. The efficiency in either mode of operation was found to be low; however, the backgrounds were favorable and good definition of characteristic lines was achieved. As a Compton coincidence spectrometer, resolutions of the 0.662-Mev gamma ray from Cs^{137} on the order of 10 percent were observed. As a pair coincidence spectrometer, the 2.75-Mev gamma ray from Na^{24} was resolved to about 7 percent. Future tests and plans for improvements are discussed. (auth)

1636 LAMS-2364

Los Alamos Scientific Lab., N. Mex.
QUARTERLY STATUS REPORT OF THE LASL PLASMA THERMOCOUPLE DEVELOPMENT PROGRAM FOR PERIOD ENDING SEPTEMBER 20, 1959. Samuel Glasstone, comp. and ed. Oct. 1959. 16p. OTS.

A "standardized" basic design of a plasma thermocouple for in-pile testing was selected. This utilizes a ZrC—UC fuel pin, $\frac{1}{4}$ in. in diameter by 1 in. long, centered within a zirconium collector, leaving a 1-mm annular gap. With a pin of ZrC—30 mole % UC solid solution, in-pile testing was carried out at various reactor power levels. A pyrometer, thermal conductivity, and life tests were accomplished. Using the plasma cell described in the preceding report, considerable information concerning its operation was obtained by means of a Langmuir-type probe. Such a probe can reasonably be expected to yield information about electron energies, electron densities, and potentials in the cesium plasma for cesium vapor pressures up to about 0.5 mm Hg. Preparation of a cathode for higher efficiency is described. The most serious obstacle to designing and constructing cells with desirable and predictable temperature distributions in the collector and insulation is the inability to maintain good thermal contact between the various radial cell walls. Experiments were carried out with spraying insulating and cladding materials on collectors. This method of fabrication offers considerable promise of eliminating difficulties with radial gaps. Anomalous thermionic emission was studied. Thermionic electron emission characteristics of $NbC_{0.94}$, $NbC_{0.47}$, and Nb metal were measured over the temperature range between 1725 and 2200°K. Weight loss data were obtained on a fuel pin (70—30 mole % ZrC—UC) heated in vacuum at about 2200°C for 212 hr. Measurements of fission cadmium ratios for ZrC—30 mole % UC were made in the Omega West Reactor. (For preceding period see LAMS-2333). (W.D.M.)

1637 MLM-CF-59-6-33

Mound Lab., Miamisburg, Ohio.
NUCLEAR BATTERY-THERMOCOUPLE TYPE; NINTH QUARTERLY PROGRESS REPORT, JANUARY 1, 1959 TO MARCH 31, 1959. B. C. Blanke. Mar. 31, 1959. 17p. DA Project No. 3-99-15-102. Contract No. R-65-8-99811-SC-03-91.

A review was made of nuclides with $Z > 81$ (mainly α-emitters), which have specific activities sufficiently high to be used as heat sources. Previous restrictions on γ-radiation intensities and methods of production were considered, but consideration of nuclides which did not meet these restrictions was not excluded. (For preceding period see MLM-CF-59-1-54.) (auth)

1638 MND-SR-1672

Martin Co. Nuclear Div., Baltimore.
STRONTIUM-90 POWER PROJECT QUARTERLY PROGRESS REPORT I. Jan. 1959. 62p. Contract AT(30-1)-2281. OTS.

The purpose of the Sr^{90} contract is to design an apparatus capable of converting the radioisotopic decay energy into a useful source of electrical power. The apparatus must have a safe, long, unattended life. Two designs will be produced during the contract study, one for land application and the other for sea application. In addition to these conceptual designs, an inoperative model will be constructed to illustrate a possible design of the land-based application. The first quarter of the Sr^{90} program was concerned with construction of the model, investigation of possible compound forms of Sr^{90}, cladding requirements, selection of energy conversion, and biological shielding. Required laboratory materials and reagents were procured as well as a small furnace, ball mill and a press for use in a fume hood. Special apparatus such as a contained corrosion test assembly for Sr^{90} tracer experiments was fabricated. Stable as well as tracer experiments are in progress to determine the corrosion resistance of various compound forms of Sr in hot and cold fresh and sea water. Similar tests are being conducted on cladding materials such as Mo, Ta, W, and Ni. Compound forms of Sr are being studied as pure ceramics, ceramics with non-metallic additives, and cermets. Cladding requirements such as element insertion and lid welding are under test. The problem of heat transfer, including a method employing helium gas under 12 atmospheres of pressure, is being analyzed. Thermal conductivity and stress measurements are 50% completed on those compounds of strontium still under examination. Of the original six compounds of strontium considered (plus two additional) five compounds were eliminated and three are still under test. Those still being tested are strontium boride, strontium titanate, and strontium zirconate. A model of the land based application is being completed. It incorporates strontium boride as the heat element compound and lead telluride thermoelectric materials for conversion of heat into electricity. A biological shielding determination was made for the land based conceptual design at Brookhaven National Laboratory. For this work, a 100-channel pulse height analyzer was employed. Tests showed that bremmstrahlung generated within the heat elements would be in the low kilovolt region and would be attenuated by the element and heat accumulator. Only those beta particles escaping from the outer ¼ inch and impinging upon the cladding would generate hard gamma radiation. A statistical evaluation of thermal conductivity from the heat elements outward and through the cladding, heat accumulator to the finned biological shield is in progress. (auth)

1639 NP-7998
Space Technology Labs., Inc. Physical Research Lab., Los Angeles.
AN ELECTRONIC FRAMING CAMERA FOR MILLIMICROSECOND PHOTOGRAPHY. George L. Clark. [1958]. 16p.

For presentation at the Wescon Conference, Western Electronic Show and Convention, August 19-22, 1958.

The design of an electronic camera is described which sets it apart from the high-speed photographic techniques. It transforms the shuttering problem from the mechanical realm to the control of an electron beam. The acceleration of the electrons provides a mechanism for putting energy into the image. An image converter can produce an image of greater intensity than the object being photographed and there is no mechanical motion involved in the taking of a picture. The camera is always ready to take a picture and can be triggered from the event to be photographed. These facts, together with the flexibility and ease of operation of this camera, make it an extremely valuable research tool. (auth)

1640 NRL-5317
Naval Research Lab., Washington, D. C.
HIGH-CURRENT GRID-CONTROLLED ELECTRON MULTIPLIER TUBE. G. L. Stambach, W. J. Graham, and T. E. Hanley. Apr. 8, 1959. 13p. Projects NE 071-200-1 and NA 442-002.

A grid-controlled secondary-emission electron multiplier amplifier tube has been designed and built which can deliver an output pulse of five amperes into a load impedance of 100 ohms, with a rise time of less than 10 millimicroseconds and a transit time of less than 20 millimicroseconds. The measured transconductance of the tube is 600,000 μmhos, and it can provide a positive output pulse with a positive grid input. The tube is constructed as a series of concentric cylinders, with the grid and cathode structure of a 6AG7 pentode serving as a controlled emitter source. Outside the last grid, a series of four louvered, concentric dynodes are placed, with the first dynode serving as the missing pentode plate. Outside the last dynode is a screen-mesh collector and a fifth dynode. From the fifth dynode, a solid cylinder, the output pulse is taken. The concentric geometry has several advantages. Space-charge difficulties are decreased because the current gain at each dynode may be kept at a high level without increasing the current density in proportion. Furthermore, the geometry is suited to a coaxial input and output for obtaining optimum rise-time characteristics. (auth)

1641 NYO-2654
Evans Research and Development Corp., New York.
THE DEVELOPMENT OF A BETA-RAY PARTICLE SIZE ANALYZER. Quarterly Technical Status Report [for] July 16—October 15, 1959. 11p. Contract AT(30-1)-2372. OTS.

Studies were continued on the development of a beta-ray particle size analyzer. Investigations were made of suitable sources for the particle size analyzer. Data are included from an evaluation of bonded tritiated titanium foil, a strontium-90 sealed source, and a carbon-14 source. (C.H.)

1642 ORNL-2787
Oak Ridge National Lab., Tenn.
INSTRUMENTATION AND CONTROLS DIVISION ANNUAL PROGRESS REPORT FOR PERIOD ENDING JULY 1, 1959. Nov. 2, 1959. 152p. OTS.

Instrumentation and controls development for various projects is summarized. Among the items reported on are a 2048 channel neutron time-of-flight analyzer, a versatile instrument camera with a microsecond electronic shutter, grid current in electrometer tubes, personal radiation monitor, systems analysis, additions and modifications to the instrumentation of the Fission Products Pilot Plant, instruments and controls for the Maritime Ship Reactor pressurized water experiment in the ORR, and Homogeneous Reactor Project instrumentation and controls. (For preceding period see ORNL-2647). (W.D.M.)

1643 ORNL-2794
Oak Ridge National Lab., Tenn.
A MAGNETIC CORE CIRCUIT FOR THE RELIABLE PRODUCTION OF SINGLE PULSES FROM CONTACTS. R. J. Klein. Nov. 11, 1959. 47p. Contract W-7405-eng-26. OTS.

The results of this investigation indicate that under certain conditions, a relatively simple magnetic core circuit may be used to reliably produce single pulses from the irregular current waveform generated by closing contacts. This circuit contains no active elements and does not draw stand-by power. In applications such as manually operated switches or slow speed machinery where the total number of switch operations expected is less than about one-hundred million, a considerable improvement in reliability may result with this circuit compared with one which depends upon active elements which deteriorate with time. For applications requiring more total operations, special contact materials may be required to withstand the eroding effects of the rather high peak currents required by the magnetic core circuit. The design freedom resulting from the d-c isolation of the output circuit and the possibility of having several output circuits with different pulse amplitudes and d-c levels is another desirable feature of this approach. (auth)

1644 RIB-41
DuMont (Allen B.) Labs., Inc. Electronic Tube Div., Clifton, N. J.
DEVELOPMENT OF PHOTOMULTIPLIER TUBES. Report No. 30 [for] November 1, 1958 to August 15, 1959. William A. Snell and Y. C. Kim. 30p. Contract AT(30-1)-1336. OTS.

A study was made of the feasibility of using a "mull" method for measuring the transit time dispersion of photomultiplier tubes. An optical system and associated mechanical equipment were designed, built and assembled in a light-tight box. The electronic circuitry required for the measurements was designed and tested. (J.E.D.)

1645 SC-1234(TR)
Sandia Corp., Albuquerque, N. Mex.
DATA REDUCTION METHODS WITH IMPACT CAMERA. H. L. Rogers. Nov. 29, 1949. Changed from OFFICIAL USE ONLY Apr. 12, 1956. 18p. OTS.

Design of an impact camera is described. Because of the many changes and improvements on previous impact cameras, a new approach was made to data reduction problems. Many small geometrical instrumental errors present were reduced by finding constant-correction factors. These correction constants are found for each glass plate used in the camera. A two-camera method of data reduction for finding the space co-ordinates of an object was also developed and, for convenience in future computations and analyses, this method was integrated with the Askania methods for data reduction. (auth)

1646 SCTM-170-57(52)
Sandia Corp., Albuquerque, N. Mex.
A DISCUSSION OF TECHNIQUES FOR MAKING SMALL THERMOCOUPLES. C. M. Stover. Aug. 7, 1957. 17p. Contract AT(29-1)-789. OTS.

A problem in making small thermocouples is the welding and handling of very small diameter wire. Techniques are described for butt-welding and spot-welding of wire 0.010 in. in diameter and smaller. Procedures are given for making single-ended tip thermocouples of small-diameter and surface-temperature button thermocouples. (auth)

1647 UCRL-8526(Rev.)
California. Univ., Berkeley. Lawrence Radiation Lab.
INFLATABLE GASKET FOR THE 72-INCH BUBBLE CHAMBER. Luther R. Lucas and H. Paul Hernandez. July 1959. 48p. Contract W-7405-eng-48. OTS.

A satisfactory glass-to-metal seal at liquid hydrogen temperatures has been developed for the large oval-shaped optical window of the 72-in. liquid hydrogen bubble chamber. Indium wire is held in contact with the chamber glass by an inflatable stainless steel member capable of 160 mils useful deflection. During cooldown to liquid hydrogen temperatures, the stainless steel chamber shrinks about $^3/_{16}$ in. more than the glass, causing a relative translation between the contacting surfaces. To avoid opening leaks, the gasket is not sealed until the cooldown is nearly completed. Only a nominal inflation pressure (~50 psig) is used during the cooldown, enough to keep the assembled parts in position without mashing the indium. At about 77°K, after most of the relative shrinkage has occurred, the inflation pressure is increased to between 400 and 600 psig, mashing the indium and making the seal. With a double row of indium wires, the bearing stress on the glass is only ~800 psi at an inflation pressure of 400 psig. Since the BSC-517/645 glass should be able to withstand a compressive stress on the order of 10,000 psi for this gasket geometry, an adequate margin of safety should exist. Because a multiplicity of seals with pumpouts between each seal is used, it is not necessary that each seal be tight to a helium leak detector, as long as the vacuum pumps can handle the leaks. In practice it was found that after an initial period of chamber pulsing the seal improves. A vacuum in the range of 10^{-5} to 10^{-6} mm Hg can be held above the glass, with a liquid pressure below the glass varying from 95 to 30 psig. Pressures in the chamber-side and glass-side pumpouts vary from 10μ to 1000μ, and in the glass-edge pumpout the pressure is about 50μ. During the first liquid hydrogen operation the chamber was cycled from room temperature to low absolute temperatures (27°K) three times with the same set of gaskets. (auth)

1648 UNM-TR-EE-18
New Mexico. Univ., Albuquerque. Engineering Experiment Station.
SAFE THERMAL OPERATION OF POWER TRANSISTORS UNDER PULSED EXCITATION. George R. Swain and W. W. Grannemann. Sept. 1958. 75p. For Sandia Corp. [Contract AT(29-1)789]. (SCDC-910). OTS.

A method by which the circuit designer may determine if a specified maximum internal temperature of a transistor will be exceeded, or if a transistor will enter thermal runaway for a given set of operating conditions is described. The method is derived by applying the theory of solid-state heat flow to simplified thermal models of power transistors. Laplace transforms are used to solve the differential equations of heat flow. Stability is analyzed by considering a linear approximation to the variation of heat dissipated with temperature. For safe thermal operation, the allowable input power to a transistor as determined by maximum permissible temperature alone must be derated. The derating factor is proportional to collector voltages, saturation current at ambient temperature, thermal resistance from collector junction to ambient, and circuit stability factor. The temperature at which thermal runaway occurs varies as the logarithm of the reciprocal of these same quantities. These conditions may be used as a criterion for safe thermal operation for low frequency and switching applications. (auth)

1649 USNRDL-TR-349
Naval Radiological Defense Lab., San Francisco.
METHODS OF FABRICATING ALPHA PARTICLE SCINTILLATION SCREENS. L. D. Miller and P. N. Peterson. July 24, 1959. 79p.

A suitable scintillation screen for use in an alpha detection system was developed. Zinc sulfide was used as the scintillation phosphor and was deposited by means of a bonding solution onto a transparent backing plate. To exclude ambient light and to afford some amount of light reflection, the phosphor was covered with a double aluminum coated $^1/_4$ mil Mylar sheet. The Mylar sheet was bonded to the phosphor by means of an edging of 100% solids adhesive. Since the scintillation screen was to be covered by a fine wire mesh, the finished detector (with a moderately rugged light-tight covering) was considered adequate. The over-all alpha particle energy attenuation was less than 1 Mev. (auth)

1650 WADC-TR-58-392
SKF Industries, Inc., Philadelphia.
ENDURANCE TESTS OF ROLLING CONTACT BEARINGS

OF CONVENTIONAL AND HIGH TEMPERATURE STEELS UNDER CONDITIONS SIMULATING AIRCRAFT GAS TURBINE APPLICATIONS. Period covered: February 1953 to February 1958. H. O. Walp, R. P. Remorenko, and J. V. Porter. Mar. 1959. 90p. Contract AF33(600)-22860. (AD-212904).

Endurance tests of rolling contact bearings of conventional and high temperature steels were conducted at two temperature levels and at normal and high speeds. Test results indicate that the fatigue life of the high temperature steels is materially increased by vacuum melting. High-speed ball bearings, alike in all respects except for ball diameter variations, were tested at high speed to study dimensional effect on endurance life. Results of the endurance tests indicate no correlation of individual bearing life with observed dimensional variations for the same bearings. To provide a means of determining the fatigue properties of materials without using complete bearings, simple specimen testing machines were designed and operated. Results of these tests, based on median test lives, seem to indicate some correlation with the lives of deep groove bearings made from the same materials. (auth)

1651

A NEW TYPE OF COSMIC RADIATION PULSE SPECTROGRAPH. O. C. Allkofer (Universität, Kiel). Atomkernenergie 4, 389-95(1959) Oct. (In German)

A cosmic-ray spectrograph is described for measuring the momentum spectrum and the positive excess in cosmic rays. The registration of the particles is done by parallel-plate spark counters, three of which are placed above the magnetic field and three below. When a coincidence occurs, the sparks will be intensified by electronic means and photographed. The deflection of the particles is done by a permanent magnet; the face area of the magnet is 5 × 20 cm^2 and the distance between the poles is 2.5 cm; the strength of the magnetic field is 4000 gauss. The small error incurred in measurements of the single sparks (0.24 mm.), less expense, and smaller size gives this apparatus a certain advantage over the spectrographs which employ layers of G. M. counters to register the particles. (auth)

1652

A LARGE α-SPECTROMETER. S. A. Baranov, A. G. Zelenkov, G. Ya. Shcehepkin, V. V. Beruchko, and A. F. Malov. Atomnaya Energ. 7, 262-4(1959) Sept. (In Russian)

Descriptions are given of the design and performance of an α spectrometer with a magnet, excitation coils, and vacuum chamber of non-magnetic stainless steel. The magnetic circuit is constructed in the shape of double mushroom and consists of a cylindrical core and two "tops." The width of the pole is ~70 cm, the gap is 35 cm. The total weight of the apparatus is ~90 t; the chamber capacity is ~1000 l. The sources of α radioactive isotopes are distributed in a special device which permits the exposition of four targets in succession without disturbing the vacuum. The maximum dimensions of the source are 100 × 10 mm. The resolving power is plotted for Cm^{242} α particles. The half-width line is 3.5 kev ($H\rho/H\rho = 0.028\%$). The device exhibits a relatively high resolving power in handling α particles with half life up to 2×10^{10} years in specimens weighing up to 100 μg. (R.V.J.)

1653

RECENT DEVELOPMENTS IN RADIOISOTOPE TECHNIQUES: A SYMPOSIUM. IV. A QUANTITATIVE AUTOMATIC BODY SCANNER FOR THE LOCALISATION OF RADIOISOTOPES IN VIVO. J. R. Mallard and C. J. Peachey (Hammersmith Hospital, London). Brit. J. Radiol. 32, 652-7(1959) Oct.

The design is described of a quantitative automatic body scanner for the localization of radioisotopes in vivo. A mosaic of colored dots is built up for the area scanned, the color of dot indicating the count-rate for that point. (C.H.)

1654

EXPERIMENTS WITH A SINGLE-CHANNEL MOBILE GAMMA SPECTROGRAPH. Bull. inform. sci. et tech. (Paris) No. 32, 3-17(1959) Sept. (In French)

The SGE2 single-channel mobile gamma spectrograph and some experiments with it are described. The apparatus has an NaI(Tl) scintillator with RD 53AVP photomultiplier, a variable high voltage supply (ALS 349 CRC), amplifiers, a mobile one-channel selector with regulation from 0.5 to 15 volts, mechanical device for displacing the channel so that analysis times can be fixed at 15, 30, or 60 min, and a counting arrangement. (T.R.H.)

1655

MONITORING X-RAY TUBE OUTPUT WITH IONIZATION CHAMBER. Kenzo Tanaka, Jun-ichi Chikawa, and Tadashi Yamanaka (Kyoto Univ.). J. Phys. Soc. Japan 14, 1321-7 (1959) Oct.

The intensity of an x-ray beam can be stabilized by using an ionization chamber as a monitor which is placed between an x-ray tube and a specimen. The filament current of the tube is controlled to keep the output potential of the ionization chamber constant. The ionization chamber was designed in consideration of the response for wavelengths and the statistical fluctuation of the output voltage. Thus, high stability of a demountable x-ray tube as well as of a sealed-off one was obtained without rigorous regulation of tube voltage. If an x-ray tube is operated at 40 kvp and tube voltage is stabilized within ±1%, the fluctuation of intensity can be limited to ±0.1%. The fluctuation of intensity in a broad diffraction line of a polycrystalline specimen which was measured for five hours could not be distinguished from the statistical fluctuation. The fluctuation of intensity in a diffraction line of a single crystal was ±0.2% for the sealed-off tube and ±0.5% for the demountable one. (auth)

1656

USE OF SCINTILLATION COUNTERS IN SINGLE CRYSTAL X-RAY DIFFRACTOMETRY. P. J. Black and J. B. Forsyth (Cavendish Lab., Cambridge, Eng.). J. Sci. Instr. 36, 392-4(1959) Sept.

A scintillation counter apparatus used for single-crystal x-ray diffractometry is described. The variation of the signal/noise ratio with photomultiplier operating potential has been investigated for the Du Mont 6291 tube, and it is shown that the resolution of the signal pulses from the noise background improves as this potential is decreased. Signal resolutions of 26, 29, and 43% have been obtained with Ag$K\alpha$, Mo$K\alpha$, and Cu$K\alpha$ radiations, respectively, the mean number of photoelectrons released per kev incident quantum energy being 6. Stability criteria which will help to ensure the over-all uniformity in the counter response are suggested. (auth)

1657

SENSITIVE DETECTOR OF γ-RADIATION IN LIQUID OR GASEOUS EFFLUENTS. J. G. Mitchell (Associated Electrical Industries Ltd., Aldermaston, Berks, Eng.). J. Sci. Instr. 36, 396-8(1959) Sept.

The instrument described is a plastic-phosphor scintillation-type detector which can be used to monitor the radioactivity of liquid and gaseous effluents. With liquid effluents, it can detect activities of about 1.5×10^{-6}

$\mu c/cm^3$ of 0.7 Mev γ-radiation, and for gaseous effluents, 1/280 m.p.c. of Ar^{41} in air. The experimental determination of the optimum sensitivity of the detector system is described and results are given. The system provides a continuous day-and-night record of the activities monitored. Also, it gives automatic warning of dangerously high levels of activity and of a failure in its own electrical system. (auth)

1658

MEASUREMENT OF RELATIVE EFFICIENCY OF SCINTILLATORS BY PULSE METHODS. Josef Šilar. Jaderná energie 5, 309-13(1959). (In Czech.).

An integral and differential method for the measurement of the relative efficiency of organic and inorganic scintillators is described. The reproducibility of pulse methods is determined and the effect of the "blue" and integral photocathode sensitivity on the relative scintillator efficiency is considered. The results measured on scintillators of domestic production are compared with foreign data. (auth)

1659

THE APPLICATION OF THE SCINTILLATION COUNTER IN X-RAY STRUCTURAL ANALYSIS. D. M. Kheyker, I. Ye. Konstantinov, and V. A. Alekseyev. Kristallografiya 4, No. 1, 54-61(1959).

A scintillation counter and recorder with discriminating circuits which is suitable for use with the URS-50I diffractometer is described. Lineal and spectral characteristics are given. (TCO)

1660

A THERMO-ELECTRONIC GENERATOR. V. A. Parfenov. Nauka i Zhizn 26, No. 7, 69(1959).

A description of a thermo-electronic generator for artificial satellites for the earth and moon published in the western press is described. The project features direct conversion of thermal power into electric energy. The generator consists of 2 metal plates separated by only several thousandths of a mm and built into a vacuum tube. One plate is heated to the temperature of about 1,200, the other to 500°C. The electrons travel from the hot to the cooler plate. Connected up by a conductor, electric current can be thus produced. Thermal energy for the generator will be supplied either by an atomic reactor or by the sun. (TCO)

1661

FAST COINCIDENCE CIRCUIT WITH THREE DIODES. R. Meunier and J. Teiger (Centre d'Études Nucléaires, Saclay, France). Nuclear Instr. and Methods 5, 148-51 (1959) Sept. (In French)

A differential coincidence circuit is described which has an effective resolving time of less than one mμs. The principle consists of having two pulses traveling in opposite directions through the same coaxial cable, and they meet at a given point. The circuit was built for use on experiments with high-energy accelerators. (auth)

1662

A NEW USE OF COUNTER CONTROL IN CLOUD CHAMBER OPERATION. Robert W. Birge, Robert E. Lanou, Jr., and Marian N. Whitehead (Univ. of California, Berkeley) and Hans Courant (Univ. of California, Berkeley and Yale Univ., New Haven). Nuclear Instr. and Methods 5, 161-4(1959) Sept.

A method of cloud-chamber operation is described which in certain types of experiments can overcome the disadvantages usually inherent in the use of this instrument. The technique consists of counter-control of both the cloud chamber and the accelerator beam. By utilizing this method, it is possible to operate at beam levels considerably higher than otherwise permissible. (auth)

1663

EFFICIENCY AND TIME DISPERSION OF LIGHT COLLECTORS OF CHERENKOV DETECTOR WITH REFLECTING WALLS. J. Séguinot, M. Schérer, and J. Teiger (Université, Caen, France). Nuclear Instr. and Methods 5, 170-76(1959) Sept. (In French)

The distribution of rise time of Cherenkov pulses was measured for a Cherenkov detector of 23 × 10 × 10 cm^3 with reflecting outer surfaces, and constant output level. A method of study of linings is proposed. An efficiency of detection nearly 100% was measured. This detector is associated with cloud chambers for scattering measurements of μ mesons. (auth)

1664

ON THE OPTIMUM DIMENSIONS OF COLLIMATORS FOR NEUTRON DIFFRACTION. P. Szabó (Central Research Inst. for Physics, Budapest). Nuclear Instr. and Methods 5, 184-8(1959) Sept.

A calculation method is shown for determining the optimum dimensions of primary collimators of given collimating power for neutron diffractometers and crystal spectrometers. Exact expressions of closed form consisting of elementary functions are given for the calculation of transmitted intensity. The numerical evaluation of these expressions being rather lengthy and laborious, approximate formulas are derived too and it is shown that in case of practical interest the use of these latter and more convenient ones is quite sufficient. (auth)

1665

APPARATUS FOR THE DEVELOPMENT OF NUCLEAR EMULSION PLATES. W. Lohmann (Max-Planck-Institut für Biophysik, Frankfurt am Main). Nuclear Instr. and Methods 5, 194-5(1959) Sept.

The design of an apparatus suitable for processing nuclear emulsion plates of different thickness and type is described. (C.J.G.)

1666

ELECTRONICS FOR RADIATION DETECTION. 2. PULSE COUNTING. K. Kandiah (Atomic Energy Research Establishment, Harwell, Eng.). Nuclear Power 4, No. 43, 109-14(1959) Nov.

The characteristics and applications of pulse counting systems are summarized. Ratemeters using trigger circuits or diode pumps, binary scalers (including transistor circuits with inductance and ferrite core memories), binary coded decimal scalers, and ring scalers employing cold cathode tubes of multi-junction semiconductor devices are covered. The principles of dekatron circuits, a type using one drive transistor, and a thermionic scaling tube employing a ribbon beam are discussed. A survey is given of the uses of the trochotron and a circuit for a magnetic scaler using a ferrite core driven by transistors. (W.D.M.)

1667

SWITCHING TWO MILLION AMPS. G. M. Bracewell, J. Maycock, and G. R. Blackwell (Hawker Siddeley Nuclear Power Co., Ltd., Langley, Eng.). Nuclear Power 4, No. 43, 115-17(1959) Nov.

An experimental 39 kv vacuum switch is described which is based on a US design developed at UCRL. The design makes use of the insulating properties of vacuum and the high conductance of ionized plasma. These properties are combined to produce what is in effect a high current triggered spark gap having minimal inductance. A summary of test results is given. (W.D.M.)

1668
SOME PROBLEMS IN THE SCINTILLATION METHOD OF DETECTING NUCLEAR PARTICLES. H. Durand. Onde élec. 38, 600-5(1958) Aug.-Sept. (In French)

The operation of a scintillator and photomultiplier is first examined, starting at the absorption of a nuclear particle into the scintillating medium and proceeding to its transformation into an electric impulse. The principal parameters concerned in the successive transformations are considered one by one: absorption of the nuclear radiation (γ rays, electrons, neutrons, heavy charged particles, etc.) transformation of the energy absorbed into luminous energy, and thence the transformation of luminous pulses into electrical pulses. Finally some guides are given for the choice of scintillator for a given purpose and some technical considerations are listed on the principles of scintillators. (auth)

1669
PHOTO-MULTIPLIER DETECTORS OF NUCLEAR RADIATION. G. Pietri. Onde élec. 38, 606-16 (1958) Aug.-Sept. (In French)

The photomultiplier has revived the scintillation technique of measuring nuclear radiation, to the point of making it an essential research instrument in this field at the present time. An analysis is given of the component parts of the photomultiplier and its development. An account of equipment produced in France for this field is given and also future trends are forecast; emphasis is placed on the rapid development of this technique. (auth)

1670
A VERY SHORT LIGHT PULSE GENERATOR USED FOR TESTING PHOTOMULTIPLIERS. P. Cachon and A. Sarazin (Université, Alger, Algeria). Onde élec. 38, 617-21(1958) Aug.-Sept. (In French)

A very short light pulse generator, obtained by electronic excitation of the screen of cathode ray tube is used for testing photomultipliers. The shape and position stability of these pulses permit an accurate measurement of the transit time and the fluctuations of them. (auth)

1671
FAST ELECTRONIC CIRCUITS FOR NUCLEAR PHYSICS. J. Mey (Centre d'Études Nucléaires, Saclay, France). Onde élec. 38, 622-8(1958) Aug.-Sept. (In French)

The purpose of fast electronic circuits in the field of nuclear physics is defined. A brief description is given of the techniques and solutions used to realize the principal functions needed, emphasizing the difficulties and limitations encountered. A review is given of particle detectors, amplifiers, scalers, discriminators, pulse-height analyzers, coincidence circuits, and time-of-flight analyzers. (auth)

1672
FAST TRANSISTOR CIRCUITS. M. Combier and J. Mey (Centre d'Études Nucléaires, Saclay, France). Onde élec 38, 629-32(1958) Aug.-Sept. (In French)

Two fast transistor pulse counting circuits are described. The first is a decade using commercially available H.F. junction transistors. It is capable of counting rates up to 1.6 Mc/s. The second is a flip-flop employing surface-barrier transistors. Its intrinsic resolving time is 0.02μs and it can be used for periodic counting up to 20 Mc/s. (auth)

1673
DELAY LINE FREQUENCY DIVIDERS AND THEIR APPLICATION TO ARITHMETIC CODING. Y. Amram, H. Guillon, and B. Ollivier (Centre d'Études Nucléaires, Saclay, France). Onde élec. 38, 633-40(1958) Aug.-Sept. (In French)

The principle of a delay line frequency divider working on pulses is given along with some practical examples which have been produced by making a judicious choice of delay lines and electronic tubes. The input frequency can be many tens of Mc/s. One of the main applications envisaged is the rapid numerical coding of a variety of varibles, particularly time. An experimental apparatus working on a clock frequency of 20 Mc/s and having a capacity of 120 is described. (auth)

1674
TIME-OF-FLIGHT SPECTROMETER. 100 CHANNELS. H. Guillon (Centre d'Études Nucléaires, Saclay, France) and A. Kadjar. Onde élec. 38, 641-7(1958) Aug.-Sept. (In French)

The time-of-flight spectrometer for thermal neutrons described in this article consists of 100 channels of width varying from 10 to 200 microseconds. During the design and development, particular attention was given towards precision and reliability of the equipment. (auth)

1675
TRANSISTOR SELECTOR FOR MEASURING TIME OF FLIGHT. J. P. Duchemin and P. Gutmann (Centre d'Études Nucléaires, Saclay, France). Onde élec. 38, 648-53(1958) Aug.-Sept. (In French)

A 100 × 10 μsec transistor selector intended for the spectrometry of neutrons by measuring time of flight is described. The apparatus uses 700 transistors and includes 100 channels of variable width ($\geq$ 10 μsec) determined by delay line frequency division circuits and switching tubes working at low voltage. The recording is performed in 100 counters, preceded by 50 dekatrons or 50 binary scalers according to the value required for the resolving power (250 or 5 μsec). The analysis can be extended at will by the addition of delays which are in multiples of 90 channels. (auth)

1676
SEMI-CONDUCTOR NUCLEAR ELECTRIC BATTERIES. Nguyen Van Dong (Centre d'Etudes Nucléaires, Saclay, France). Onde élec. 38, 654-7(1958) Aug.-Sept. (In French)

Apart from the numerous uses of semi-conductors in radio, the problem of direct conversion of nuclear radiation to electrical energy is an interesting application. Rappaport demonstrated this effect by irradiating germanium and silicon p-n junctions by β particles from a Sr^{90}-Y^{90} source. Since then research work has been carried out in this field in various laboratories particularly in the U.S. and U.S.S.R. With a Sr^{90}-Y^{90}source of 70 millicuries activity, and a silicon junction, an electric power of 1 μ W is obtained with an efficiency of 1%. The structural faults produced in the crystal by β particles with an excessive energy reduces the power and efficiency considerably from its initial value. (auth)

1677
BORON TRIFLUORIDE COUNTERS. Onde élec. 38, 660-1 (1958) Aug.-Sept. (In French)

A series of BF$_3$ counters is described which consists of 15 instruments with sensitivities ranging from 0.06 to 73 counts/sec. (T.R.H.)

1678
MEASUREMENT BY SCINTILLATION OF THE LOW ACTIVITIES OF CARBON-14 AND TRITIUM. R. Bibron (Centre d'Études Nucléaires, Saclay, France). Onde élec. No. 382, 6p. (1959) Jan. (In French)

An apparatus and method for measuring the very low activities of C^{14} and T are described. Two photomultipliers are used with a coincidence selector which rejects noise pulses. Further noise reduction is gained by operation of the photomultipliers at low temperatures. Performance of the method on a tritium count is described. (T.R.H.)

1679

CONTROL INSTALLATION OF AQUILON REACTOR. G. Friedling (Centre d'Études Nucléaires, Saclay, France). Onde élec. No. 382, 6p.(1959) Jan. (In French)

The Aquilon reactor for study of U—D_2O lattices is briefly described and its instrumentation and control panel is presented in detail. (T.R.H.)

1680

EXAMINATION OF FISSION FRAGMENT TRACKS WITH AN ELECTRON MICROSCOPE. E. C. H. Silk and R. S. Barnes (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Phil. Mag. (8) 4, 970-2(1959) Aug.

Thin sheets, removed by cleavage from the surface layers of mica exposed to fission fragments from uranium, were examined in transmission in the electron microscope. Fission fragment tracks which are less than 300 A in diameter and greater than four microns in length were seen superimposed upon a general background introduced by associated neutron bombardment. The nature of the trakcs is discussed. The technique can be used to study radiation induced atomic displacements and the nature and behavior of the particles with high resolution. (auth)

1681

EXPERIMENT OF DOSIMETRY OF X-RAY AND γ-RAY RADIATIONS AND OF DETERMINATION OF CONCENTRATION OF RADIOACTIVE AEROSOLS IN OPERATORS' POSITIONS. Kvetoslav Spurny and Helena Kloudova. Pracovní lékařství 10, 167-70(1958). (Translated from Referat. Zhur. Khim. No. 2, 1959, Abstract No. 5185).

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 726.

1682

ANALYSIS OF RESIDUAL GASES REMAINING AT VERY LOW PRESSURES. J. Amoignon and G. Mongodin (Commissariat à l'Énergie Atomique, Paris). Vide 71, 371-6(1957) Sept.-Oct. (In French and English)

The problem of the analysis of residual gases left at very low pressures seems to be best dealt with by the use of mass spectrography. However, instruments of the classical type cannot be adapted to this particular form of analysis. A special type of spectrometer is necessary, in which the ion source, deflector, and target are placed directly in the gas to be analyzed, and whose working pressure is precisely that present in the enclosure being tested. The ionic resonance spectrometer, which is extremely compact, possesses all the required properties, and it is an instrument of this type which was adopted and constructed for the analysis of residual gases. A brief description of the apparatus is given, together with an indication of the results of analysis already carried out. (auth)

1683

THEORETICAL STUDY OF IONIC RESONANCE SPECTROMETER. J. Amoignon and G. Rommel (Commissariat à l' Énergie Atomique, Paris). Vide 71, 377-82(1957) Sept.-Oct. (In French)

The analysis of residual gases at very low pressures requires a very compact ionic resonance mass spectrometer designed for total immersion in the volume tested. The various ion trajectories of such a spectrometer are determined, and the data necessary for the construction and calibration are obtained. A simplified unit is used as the basis for discussion: The gas is ionized by an electron beam emitted by a filament, and the ions formed are subjected to a variable electric field applied between two parallel plates and to a perpendicular magnetic field created by a permanent magnet. The measurement of the ion current will give, as a function of the frequency, the nature of the gas and its partial pressure. (auth)

1684

GAMMA RAYS IN DETECTION OF SURFACE TENSION AND MARGIN ANGLE AT HIGH TEMPERATURES. D. M. Ziv and B. I. Shestakov. Zhur. Priklad. Khim. 32, 1767-70 (1959) Aug. (In Russian)

The method can be used for determining the surface tension and angle of wetting at high temperatures and in opaque media. Commercially produced Eu^{154} and Ir^{192} are the most suitable γ sources. (R.V.J.)

1685

ELEMENTY SISTEM AVTOMATICHESKOGO REGULIROVANIYA. CH. 1: CHUVSTVITEL'NYYE USILITEL'NYYE I ISPOLNITEL'NYYE ELEMENTY. (Elements of Automatic Control Systems. Pt. 1: Sensing, Amplifying and Control Elements). Moscow, Mashgiz, 1959. 722p.

The operation principles of automatic control elements and servomechanisms are discussed along with typical automatic control circuits. Equations of motion and static and dynamic characteristics of automatic control elements are also discussed as well as sensing elements, amplifiers, control elements, and transducers. The book contains Sections I, II, and III of Part 1, Volume II, Principles of Automatic Control. (TCO)

1686

PLASMA GENERATOR. (to U. S. Atomic Energy Commission). British Patent 821,744. Oct. 14, 1959.

A plasma generator is described. It consists of a pair of Ta electrodes loaded with a gas to be ionized spaced by ceramic insulation. The electrodes are out of axial alignment so that the arc current path is inclined from the electrode current path establishing a magnetic field to shape and expand the plasma. The generator is energized by a circuit including a capacitor, a discharge tube, and a pulse generator. The capacitor discharges through the electrodes when the discharge tube is triggered by the pulse generator. (T.R.H.)

1687

IMPROVEMENTS IN OR RELATING TO LEVEL-INDICATING GAUGES OPERATED BY RADIATION. (to Landis and Gyr AG). British Patent 822,105. Oct. 21, 1959.

A liquid-level gage of greater reliability is described. A radioactive source and counter tube are deployed as the detector element. A differential amplifier with one glow discharge tube relay for the upper level limit and another for the lower is provided. The counting tube is R-C coupled to the amplifier to convert pulses into a voltage proportional to the mean pulse frequency. The anodes of the amplifier are connected to the starters of the glow discharge tubes. Thus both tubes fire when the level is correct, only one when incorrect, and neither for a malfunction. (T.R.H.)

1688

A METHOD OF MEASURING THE IONIZING ACTION OF RADIATION. Yu. M. Tolchenov, Yu. N. Sachkov, and V. G. Chaykovskii. U.S.S.R. Patent 118554. Byull. Izobret., 1959, No. 6.

To expand the measuring range of the Geiger counter, a sufficient voltage is applied to the electrodes of the counter to maintain a continuous corona discharge. The intensity of the radiation is determined by the amount of voltage drop on these electrodes. (TCO)

1689
A NUCLEAR RESONANCE MAGNETOMETER. A. Ya. Rotshteyn. U.S.S.R. Patent 118622. Byull. Izobret., 1959, No. 6.

A magnetometer working on the principle of free nuclear inductance, provided with two pick-ups, amplifiers, and a frequency meter is described. Each pick-up consists of a vessel with hydrogen-containing liquid and of measuring and polarizing windings. To obtain the continuous measuring process necessary during the magnetic survey in motion, the magnetometer is provided with a high-frequency generator feeding the polarizing windings and securing a continuous polarization of pick-up cores, and with a commutator switching in-turn the amplifier outputs of the frequency meter. (auth)

Materials Testing

1690 KAPL-M-GLC-4
Knolls Atomic Power Lab., Schenectady, N. Y.
A REMOTELY OPERABLE CONTROLLED RADIUS BEND FATIGUE APPARATUS. G. L. Cutler. Oct. 20, 1959. 11p. Contract W-31-109-Eng-52. OTS.

A controlled radius reverse bend fatigue machine for both standard and remote operation was designed, built, and tested. After construction and various minor design changes, the apparatus was tested and remotely operated in the Radioactive Materials Laboratory. (auth)

1691 WADC-TR-57-438
Massachusetts Inst. of Tech., Cambridge.
MAGNETOSTRICTIVE DRIVE TECHNIQUES FOR FATIGUE TESTING OF METALS ABOVE 10 KILOCYCLES. P. J. Brosens, R. W. Reid, and T. P. Rona. Dec. 1957. 117p. Project No. 3066. Contract AF33(616)-3233. (AD-205547; PB-151565). OTS.

An investigation program is described in which the purpose was to study high-frequency metal fatigue applicable to turbine blades in the 12.8 kcps frequency domain. Whereas originally the work was directed toward fatigue characteristics and mode determination, it soon appeared more expedient to branch out in study of the detection and calibration methods; of the analytical and experimental approach of the impedance match problem between source and load; of the evaluation of other methods of excitation and in the use of the existing equipment to trace fatigue development by frequency and damping measurements. In the above areas, a light modulation technique has been developed successfully for the determination of vibration amplitude. A magnetostrictive impedance probe has been designed, constructed, and tested but it has not been found of considerable usefulness in the excitation of small specimens. A number of fatigue failures have been obtained in selected specimens at 12.8 kcps and changes in oscillatory characteristics did in each case precede failure; the experimental program has been judged insufficient to warrant specific conclusions but certainly adequate to recommend further work in the field. (auth)

1692 WAL-TR-112/87-8
Watertown Arsenal Lab., Mass.
MULTIPLE BLOW TRANSITIONS IN CHARPY TESTING. George M. Orner and Carl E. Hartbower. Nov. 1959. 16p. DA Project 5B93-32-002. OTS.

Investigations using a multiple-blow technique in Charpy impact testing have demonstrated an abrupt inflection in the low-energy range of the energy-to-propagate transition curve. It was desired to determine the effect of variations in the magnitude of low-blow (and accompanying cracking) on the low-blow transition temperature. It was also desired to throw some light on an abrupt discontinuity in total energy plots involving the sum of two or more blows. (auth)

1693 AEC-tr-3867
EXPERIMENTAL VERIFICATION OF THE APPLICABILITY OF THE WAVE EQUATION TO THE COMPUTATION OF MACHINE PARTS FOR STABILITY IN LONGITUDINAL IMPACT. S. C. Mazitov. Translated for Los Alamos Scientific Lab. from Izvest. Otdel. Estestven. Nauk, Akad. Nauk Tadzhik. S.S.R. 13, 65-75(1956). 17p. JCL or LC.

Fundamental theoretical solutions for determination of longitudinal impact are investigated. Examples of cases such as longitudinal impact of a load on a rod clamped at one end, and that for two suspended steel rods are solved. (J.R.D.)

GEOLOGY, MINERALOGY, AND METEOROLOGY

1694 JEN-54
Spain. Junta de Energia Nuclear, Madrid.
CARACTERIZACIÓN TERMOGRAVIMÉTRICA DE UN MINERAL DE COBRE Y URANIO DE Nª Sª DE LA CABEZA (JAÉN). (Thermogravimetric Characterization of a Mineral of Copper and Uranium of Nuestra Señora de la Cabeza (Jaén)). L. Gascó Sánchez, T. Batuecas Rodríguez, H. Sanz García, and R. Fernández Cellini. 1957. 13p.

The thermogravimetric technique is applied to the determination of the constituents of a mineral of uranium and copper discovered in a filon of the La Virgen mine in Nuestra Señora de la Cabeza (Jaén). The thermal decomposition curve up to 1000°C was obtained with a Chevenard balance modified to record automatically. The results are discussed and compared with the results obtained by chemical methods. (tr-auth)

1695 AEC-tr-3799
MICROAEROLOGICAL INVESTIGATIONS OF THE LOWER KILOMETER LAYER OF THE ATMOSPHERE. (Mikroaerologicheskie Issledovaniya Nizhnego Kilometrovogo Sloya Atmosfery). V. A. Devyatova. Translated from a publication of the Hydrometeorological Publishing House, Leningrad, 1957. 167p. OTS.

The microaerological characteristics of the layer of the atmosphere up to altitudes of 800 to 1,000 meters with regard to problems of around-the-clock variations and the distribution of temperature, specific humidity, and wind velocity at various altitudes are discussed. Certain characteristics of the atmospheric turbulence in this layer were also examined. To carry out these investigations, use was made of data provided by 50 special around-the-clock series of aerostatic ascensions made at the Central Aerological Observatory during 1950 to 1954. (auth)

1696 AEC-tr-3815
ON THE THEORY OF NEUTRON LOGGING. Yu. P. Bulashevich. Translated from Izvest. Akad. Nauk S.S.S.R., Ser. Geofiz., No. 3, 31-6(1951). 15p. (Includes original, 6p.). JCL or LC.

A solution for the thermal neutron diffusion equation is presented which takes into account the source moderation of fast neutrons. Curves representing the neutron density distribution around the source are included for a series of rocks characteristic of petroleum fields. The behavior of neutron diagrams is also examined in relation to the change of magnitudes of a probe. (J.R.D.)

1697

RESULTS OF AIR RADIOACTIVITY MEASUREMENTS IN THE VICINITY OF THE URANIUM-CONTAINING TERTIARY LIGNITES OF WACKERSDORF/OPF. R. Reiter (Physikalisch-Bioklimatischen Forschungsstelle, Munich) and H. Ziehr (Bayerischen Braunkohlen-Industrie AG, Schwandorf, Ger.). Atomkernenergie 4, 409-15(1959) Oct. (In German)

The lignite of Wackersdorf near Schwandorf, Bavaria, contains uranium and that in the surface of the open-cast mine. Measurements of the air radioactivity, however, which have been carried out regularly in the mine and its immediate neighborhood for nearly two years, don't suggest any noticeable increase of the concentration of radon and its disintegration products, caused by the uranium, in the atmosperic layer near the ground. An average of about 10^{-10} c RaB is found per m^3. Much more than by the presence of the (roughly estimated) amount of 100 tons of uranium in the Wackersdorf lignite (the uranium being not yet in equilibrium with radium), the out-of-doors air radioactivity values are influenced, according to meteorological circumstances, by the other geological conditions in that region, i.e., by the igneous rocks of East Bavaria, which near Schwandorf border upon sedimentary rocks. Indoors air radioactivity measurements showed that, by the presence of uranium ore samples of few kilograms, a radon concentration of 10^{-7} c/m^3 may be reached in the air of the room. It can be easily diminished to normal by daily airing, or by continuously working ventilators. The air radioactivity measurements carried out within the working rooms and above the lignite of the open-cast mine near Wackersdorf have shown that here, and consequently also under any comparable conditions, the air radioactivity control requires relatively little trouble and cost. The measurements have demonstrated that from the out-of-doors air radioactivity caused by the uranium contents of the Wackersdorf lignite no biological danger results for the mine staff nor for the inhabitants of the surrounding towns and villages either. (auth)

1698

THE GENESIS OF CARBONATE APATITES. L. L. Ames, Jr. (General Electric Co., Richland, Wash.). Econ. Geol. 54, 829-41(1959) Aug.

A portion of the system $Na_3PO_4-CaCO_3-H_2O$ was investigated at low temperatures. The formation of a carbonate apatite by phosphate replacement of calcite in alkaline solutions and the structural positions of the carbonate groups are discussed. Data indicate calcite replacement by low concentrations of phosphate to be the principal mechanism of formation of marine phosphorite deposits. (auth)

1699

PENECONCORDANT URANIUM DEPOSIT—A PROPOSED TERM. Warren I. Finch (U. S. Geological Survey, Denver). Econ. Geol. 54, 944-6(1959) Aug.

Peneconcordant uranium deposits cover a widespread and important type of uránium deposits that have a common and distinctive form, namely, nearly concordant to the bedding of the host rock. The term describes the form of the numerous and highly productive uranium deposits in sedimentary rocks of the Colorado Plateau, Wyoming, North and South Dakota, and Texas. The term is readily applicable to field usage. (J.E.D.)

1700

CERTAIN PROBLEMS OF THE GENESIS OF URANIUM MINERALIZATION IN CONNECTION WITH THE STUDY OF EFFECTIVE POROSITY OF ORE-CONTAINING CARBONACEOUS ROCKS. V. I. Danchev and V. V. Ol'kha. Izvest. Akad. Nauk S.S.S.R., Ser. Geol., No. 7, 16-25(1959).

The degree of porosity of ore-bearing rocks was investigated. The samples, previously dried out in a vacuum, were soaked in water. The difference in weight of a sample gives an idea of the volume of pores of the said sample and the relation between the volume of pores and that of rocks gives the factor of effective porosity (PEF). Samples were taken from widely spread varieties of ore-bearing rocks such as limestones of oolithic structure, limestones of organogenic structure, and dolomites and calcareous dolomites of crystalline structure. The results showed that samples of the first two groups have a much lower effective porosity factor (4.3 and 5.2%) than those of the third group (10.2%). Thus, dolomites and calcareous dolomites of crystalline structure have the highest porosity factor and at the same time contain only small quantities of uranium ores. The correlation between uranium content and the effective porosity of rocks is shown. Extensive radiographic study of the distribution of uranium in different parts of ore deposits shows that dispersional forms of mineralization prevail in those parts of deposits which are less subject to the recrystallization and lixiviation processes. This confirms the theory of the primarily-sedimented genesis of mineralization. In rich ores, with a higher effective porosity factor, the prevailing veined mineralization is a result of a process of epigenetic migration of mineral ore-components. (TCO)

1701

STUDY OF THE RADIOACTIVE CONTENT OF WATER AND GASES FROM THERMAL SOURCES AT LA BOURBOULE, LE MONT-DORE AND ROYAT. A. Fritsch, I. Pinset, and J. Coursaget (Commissariat à l'Énergie Atomique, Paris). J. radiol. et électroi. 39, 148-51(1958). (In French)

Measurements of the radon and radium content of thermal water and gases from various thermal stations in the Central Massif were carried out using an ionization chamber. The results obtained can account for certain divergences between results published by other authors. These measurements have made it possible to estimate the doses of radiation to which the patients and the attending personnel are exposed. The doses received in the trachea by patients after inhaling gases at La Bourboule would be about 240 rem for a 21 day cure. This dose is high with respect to the maximum annual dose allowed for workers exposed to ionizing radiations in the course of duty, but low with respect to the doses used in radiotherapy. (auth)

1702

URANIUM DEPOSITS IN THE NORD-LIMOUSIN. I. GENERAL CHARACTERISTICS OF THE URANIFEROUS PROVINCE OF NORD-LIMOUSIN. Jean A. Sarcia and Jacqueline A. Sarcia. Sci. terre (Ann. école natl. supérieure géol. appl. prospection minière univ. Nancy) 4, 241-50(1956). (In French)

The characteristics of the Nord-Limousin region, which is comprised of the departments of Correze, Haute-Vienne, and Creuse, are briefly described. The principal petrographic, metallogenic, and tectonic features are considered, with emphasis on the uranium mineral deposits. The brief discussion is presented as a general introduction to detailed studies of the region. (J.S.R.)

1703

THE URANIUM DEPOSITS OF THE NORD-LIMOUSIN. II. THE HENRIETTE MINE. Jean Sarcia and Jacqueline A. Sarcia. Sci. terre (Ann. école natl. supérieure géol. appl. prospection minière univ. Nancy) 4, 253-306(1956). (In French)

The Henriette Mine was the first producer of ores rich in uranium. The history of the discovery of the mine is traced, and the methods used for its exploration are described. The Henriette Mine constitutes a type of intragranulite uranium ore remarkable for the simplicity of its structure and the richness of its ores concentrated in open fissures in the vicinity of lamprophyric veins. In addition to a study of the mineralogic characteristics of the mine, the fine structures of the ores and encasing rocks are described. The parallelism between the evolution of the granulite itself and that of the classic pegmatites which are connected with it is stressed. The facies of the uranium mineralization was studied as a function of the type of irregularity where it is concentrated: open fissures or faults. With respect to the age of the pitchblende of the Henriette Mine (Trias to Jurassic), the question is discussed of the possible relationships between the availability and the concentration of uranium in the fissures and its long evolution well after the Hercynian upheaval. (tr-auth)

1704

ELECTRICAL PROPERTIES OF SANDSTONES OF THE MORRISON FORMATION. George V. Keller. U. S. Geol. Survey Bull. 1052-J. 1959. 39p., 2 illus. $0.55(GPO).

The electrical properties of the Morrison formation in the Uravan mineral belt of the Colorado Plateau have been studied to determine whether there are anomalous variations in these properties in and near zones of uranium-vanadium minerals which might serve as a target for geophysical prospecting. Measurements of electrical properties of the Morrison formation in place were obtained by the electric logging of 147 drill holes, and measurements were made of the resistivity and porosity of 440 drill cores in the laboratory to aid in the interpretation of the electric logs. The resistivity of the sandstone members of the Morrison formation is highest in areas that are the most favorable for the occurrence of ore. This increase in resistivity is probably due to a lower water saturation or a lower salinity of the water in the favorable areas. (auth)

1705

GEOCHEMISTRY OF URANIUM IN PHOSPHORITES AND BLACK SHALES OF THE PHOSPHORIA FORMATION. Richard P. Sheldon. U. S. Geol. Survey Bull. 1084-D. 1959. 36p. $0.20(GPO).

The distribution of uranium in the Phosphoria formation depends closely upon the depositional environment of the Phosphoria sediments. These environments probably changed progressively, from the deeper basin parts towards the shallow shelf parts of the Phosphoria sea, from acid reducing to alkaline reducing to alkaline oxidizing. In the acid reducing environment uraniferous carbonaceous shale was deposited, and the uranium possibly is present as finely disseminated UO_2. In the alkaline-reducing environment, carbonaceous phosphorite and carbonate rock were deposited, and the uranium is present in apatite, in part as U(IV) substituting for calcium in the apatite lattice and in part as the uranyl ion adsorbed to apatite crystal surfaces. In the alkaline oxidizing environment, noncarbonaceous sediments accumulated, and uranium is sparingly present in apatite, possibly as both U(IV) and U(VI). (auth)

1706

DISTRIBUTION OF CHEMICAL ELEMENTS IN THE SALT WASH MEMBER OF THE MORRISON FORMATION, JO DANDY AREA, MONTROSE COUNTY, COLORADO. William L. Newman and Donald P. Elston. U. S. Geol. Survey Bull. 1084-E. 1959. 38p. $0.20(GPO).

The chemical composition of each rock type of the Salt Wash member of the Morrison formation in the Jo Dandy area is remarkably uniform. The chemical composition of red mudstone cannot be distinguished from the chemical composition of green mudstone except for the concentration of calcium; red mudstone samples contain about twice as much calcium as green mudstone in the area studied. Oxidized sandstone contains somewhat more aluminum, manganese, and zirconium, and about half as much calcium, strontium, and copper, as unoxidized sandstone. Sandstone of the Jo Dandy area contains less aluminum, barium, zirconium, and manganese, but more potassium, magnesium, vanadium, nickel, and cobalt than "average" sandstone of the Salt Wash. The unusual amount of bismuth in some samples of host rock in the Jo Dandy area, and the occurrence of bismuth in samples of gypsum suggest that bismuth and probably some potassium and magnesium in rocks of the Salt Wash member were derived from the Paradox member of the Hermosa formation. The persistently high concentrations of vanadium in the host rocks of the Jo Dandy area as compared to the vanadium content of average sandstone of the Salt Wash member suggests that vanadium may be useful as a pathfinder element in geochemical prospecting. (auth)

1707

URANIUM RESOURCES OF THE CEDAR MOUNTAIN AREA, EMERY COUNTY, UTAH. A REGIONAL SYNTHESIS. Henry S. Johnson, Jr. U. S. Geol. Survey Bull. 1087-B. 1959. 40p. $0.20(GPO).

The results of field reconnaissance and office study of available data pertaining to the Cedar Mountain area, Emery County, Utah, are presented in this report, which is part of a series of reports synthesizing the geologic relations of uranium deposits in all stratigraphic units on the Colorado Plateau. Results suggest that the Chinle and Morrison formations and possibly the Cedar Mountain formation have further potential for sandstone-type uranium deposits in the area. Appraisals of unexposed units are based on the premise that primary sedimentary features are the major control of favorable ground, and geology and data on frequency of ore deposits are in part extrapolated from the San Rafael Swell to the Cedar Mountain area. If tectonic structural features such as the San Rafael Swell should be the major control, the uranium ore potential of the Cedar Mountain area may be considerably less than is suggested herein. The Monitor Butte member of the Chinle formation is considered generally favorable for uranium deposits in a broad northwestward-trending belt paralleling the line of pinchout of this member in the southern third of the Cedar Mountain area. The Moss Back member of the Chinle formation is thought to be generally favorable for uranium deposits over most of the southern third of the Cedar Mountain area. The Salt Wash member of the Morrison formation has been the source of about 90% of all uranium ore mined in the Cedar Mountain area but has not been found to contain deposits larger than a few hundred tons in size. Minor uranium occurrences also are known in the Brushy Basin member of the Morrison formation and in the upper shale member of the Cedar Mountain formation in the Cedar Mountain area. Uranium in these deposits is associated with carbonaceous material in siltstone or claystone, and ore grades are commonly submarginal. These units may, however, contain fairly large tonnages of low-grade uranium-bearing rock. (auth)

1708

PRELIMINARY GEOLOGIC MAP OF THE PARIA PLATEAU NE QUADRANGLE, COCONINO COUNTY, ARIZONA. MINERAL INVESTIGATIONS FIELD STUDIES

MAP MF-214. Richard G. Petersen and David A. Phoenix. Washington, U. S. Geological Survey, 1959. $0.50.

1709

PRELIMINARY GEOLOGIC MAP OF THE LITTLE CONE QUADRANGLE, SAN MIQUEL COUNTY, COLORADO. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF-223. A. L. Bush, O. T. Marsh, and R. B. Taylor. Washington, U. S. Geological Survey, 1959. $0.50.

1710

PHOTOGEOLOGIC MAP OF THE FLAT TOP MOUNTAIN NE QUADRANGLE CARBON COUNTY, WYOMING. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-301. A. B. Olson. Washington, U. S. Geological Survey, 1959. $0.50.

HEALTH AND SAFETY INCLUDING DOSIMETRY

1711 AERE-R-3000

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE CONTROL OF BERYLLIUM HANDLING AT A.E.R.E. HARWELL. R. O. R. Brooks. July 1959. 22p. BIS.

This is a revised version of AERE-Med/R-2119.

Beryllium and its compounds as potential health hazards are discussed together with methods, both engineering and medical, for protection of personnel handling beryllium in its various forms. (J.E.D.)

1712 CF-59-10-41

Oak Ridge National Lab., Tenn.

CRITICALITY ACCIDENT APPLICATION OF THE ORNL BADGE DOSIMETER. E. D. Gupton, D. M. Davis, and J. C. Hart. Oct. 14, 1959. 20p. OTS.

Nuclear accidents have emphasized the need for a personnel meter with which the radiation dose may be determined accurately in a few hours. The badge-type dosimeter developed at ORNL fulfills this need. It contains an indium foil which permits the immediate segregation of anyone who may have had a medically significant dose of neutron radiation. A gold foil is used for thermal neutron measurement and sulfur is used for fast (2.5 Mev) neutron measurement. To be meaningful the gold and sulfur measurements must be correlated with the Threshold Detector Units of the type reported by Hurst. The film used in this badge is DuPont type 553 for beta-gamma measurement and Eastman type A for neutron measurement. Provision is made in the badge for the incorporation of a chemical dosimeter and a silver phosphate glass dosimeter for the measurement of gamma radiation. (auth)

1713 KAPL-M-HP-2

Knolls Atomic Power Lab., Schenectady, N. Y.

HEALTH PHYSICS QUARTERLY REPORT, JULY–SEPTEMBER 1959. W. H. Truran, comp. 19p. Contract W-31-109-Eng-52. OTS.

No personnel radiation exposures greater than the maximum permissible radiation limits were reported during the period. Routine health physics activities are reported. (C.H.)

1714 LAMS-2319

Los Alamos Scientific Lab., N. Mex.

PROCEDURES FOR DECONTAMINATION OF PLUTONIUM FROM VARIOUS SURFACES. E. L. Christensen. Apr. 1959. 25p. Contract W-7405-eng-36. OTS.

Decontamination solutions, procedures, and their effectiveness in the removal of plutonium from various types of surfaces are reported. (auth)

1715 NARF-59-32T

Convair, Fort Worth, Tex.

FISSION PRODUCTS FIELD RELEASE TEST—1. Sept. 1959. 399p. Project No. 7809. Contract AF33(600)-32054. (AFSWC-TR-59-44; FZK-9-140).

Fission Products Field Release Test 1 was performed to check and resolve uncertainties in the currently used methods of safety analysis for nuclear aircraft. Specifically, the test was made to evaluate release percentages, airborne radioactivity, and diffusion and deposition characteristics of fission products from melted aircraft reactor fuel elements. A corollary objective was to determine the retention and distribution of the released fission products in animals located within the release network. A highly instrumented fan-shaped grid having seven concentric arcs with a maximum radius of about five miles was used to collect cloud diffusion, meteorological, radiological, radiobiological, and radioactivity deposition data. Release percentages, size of aerosols, deposition velocities, external and internal dose, fluorescent tracer behavior, and atmospheric diffusion parameters were determined. (auth)

1716 ORNL-2748(Pt.A)

Oak Ridge National Lab., Tenn.

RADIATION ACCIDENTS: DOSIMETRIC ASPECTS OF NEUTRON AND GAMMA-RAY EXPOSURES. G. S. Hurst and R. H. Ritchie, eds. Nov. 16, 1959. 114p. Contract W-7405-eng-26. OTS.

A system of dosimetry for persons involved in accidental criticality excursions is presented as part A of a two part report. The information is arranged to be useful as a reference for those responsible for implementing the system. Part A also contains a review and re-evaluation of the dosimetry of previous accidents and a synopsis of part B. Parts A and B together form a complete analysis of dosimetric and medical information pertinent to acute exposures of humans to mixed radiations. (J.R.D.)

1717 WADC-TR-57-118(II)

RCA Service Co., Inc., Camden, N. J.

A RADIOBIOLOGY GUIDE. PART II. F. DeWitt Kay, Jr. and Warren Hobson, Jr. May 1959. 126p. Project title: HEALTH HAZARDS OF MATERIALS AND RADIATION. Task title: HUMAN FACTORS OF NUCLEAR OPERATIONS. Contract AF33(616)-5491.

Part II of the USAF Radiobiology Guide examines the practical aspects of radiation protection and radiological health. The following topics are treated: biological effects of radiation, monitoring instruments and techniques, health physics, radiation exposure control, facility design, protective devices, decontamination, permissible doses, emergency procedures, medical treatment of radiation injury, handling and shipping radioactive material, and disposal of radioactive waste. Both military and nonmilitary sources were used in compiling this volume. A typical radiological laboratory has been assumed, and discussions have been directed to its requirements relating to radiation protection. A detailed table of radioisotope data also is included. (auth)

1718 JPRS-1322-N

DOSIMETRY IN IRRADIATION OF THE HUMAN HEAD BY GAMMA RAYS. Ye. V. Utekhin. Translated from Vestnik Rentgenol. i Radiol. 33, No. 3, 48-51(1958). 5p. OTS.

This paper was previously abstracted from the original and appears in NSA, Vol. 13, as abstract No. 2692.

1719 JPRS-L-698-N
METHODOLOGY OF SELECTING DUST SAMPLES FROM THE AIR WITH PARTICLE SIZES OF LESS THAN FIVE MICRONS FOR LABORATORY AND EXPERIMENTAL INVESTIGATION. N. I. Smetanin. Translated from Gigiena Truda i Professional.' Zabolevaniya 2, No. 2, 52-4(1958). 6p. OTS.

The design of an apparatus to collect dust samples from the atmosphere is described. The device, developed to collect particles of 1 to 5μ in diameter, is based on separation by centrifugal force. Construction and operation of the device are also described. (J.R.D.)

1720
ENVIRONMENTAL HAZARDS ASSOCIATED WITH THE MILLING OF URANIUM ORE. A Summary Report. W. B. Harris, A. J. Breslin, H. Glauberman, and M. S. Weinstein (U. S. Atomic Energy Commission, New York). A.M.A. Arch. Ind. Health 20, 365-82(1959) Nov.

Environmental hazards associated with the milling of uranium ore are reviewed. A flow sheet of basic processes is included. Data on the exposure of workers are tabulated. Suggestions are outlined for improving occupational conditions. (C.H.)

1721
A SURVEY OF RADIATION RECEIVED BY DENTISTS AND DENTAL ASSISTANTS. Charles K. Spalding and Russell F. Cowing (Cancer Research Inst., Boston). Am. Ind. Hyg. Assoc. J. 20, 424-7(1959) Oct.

Dental personnel receive more x-ray during their normal routine than do most others who utilize radiation for diagnostic techniques. With the proper education and evaluation of the physical hazards connected with dental x-ray machines, exposures to operators can be appreciably reduced. The interpretation of film badge readings and results of surveys conducted with ionization-type survey meters must be carefully evaluated to be of value when transposing their information into total-body exposure figures. (auth)

1722
DOSIMETRY OF β RADIATORS IN RADIATION PROTECTION. K. Sommermeyer and H. Opitz (Universität, Freiburg i B.). Atomkernenergie 4, 404-8(1959) Oct. (In German)

In handling radioactive isotopes, the fingers and the lenses of the eyes are specially sensitive to beta rays. The doses in the vicinity of the radioactive substances can easily be measured and calculated. For the measurements proportional chambers filled with methane gas are used, and for calculating "point-source" and "thick source" dose functions are used. (auth)

1723
STUDIES OF PROTECTION. Bull. inform. sci. et tech. (Paris) No. 31, 36-40(1959) July-Aug. (In French)

Reactor experimental facilities and protective measures employed in connection with their use are discussed. (T.R.H.)

1724
A SENSITIVE CHEMICAL DOSIMETER FOR IONIZING RADIATION. Gerald Oster and Barret Broyde (Polytechnic Inst. of Brooklyn). Nature 184, Suppl. No. 8, 545(1959) Aug. 15.

Methylene blue was found to oxidize when warmed to room temperature after irradiation in a plastic matrix at −10°C. This suggests that the oxidizing radicals formed in the matrix diffuse to leuco dye molecules. This gives a system more convenient and sensitive than liquid dosimeters. (T.R.H.)

1725
CONTRIBUTION TO THE PROBLEM OF SAFETY OF WORK WITH RADIOACTIVE LUMINISCENT DYES. K. Ďurček, and F. Minárik (Ustav hygieny práce a chorôb z povolania, Bratislave, Czech.). Pracovní lékařství 11, 251-4(1959). (In Czech.)

The identification of Sr^{90} in the luminescent dye Lumostabil was made. The contamination of the work area with this dye was established, and the decontamination of the work area, was accomplished. Procedures were set up to prevent the external contamination of the workers and the further spread of the contamination. Control methods for all plants working with the dye were prepared. (J.S.R.)

1726
HAZARDS IN CONTEMPORARY WORK WITH RADIOLUMINESCENT SUBSTANCES. Vladimír J. Lenger and Jan Kudrna (Hygienicko-epidemiologická stanice Univ., Prague). Pracovní lekǎrství 11, 364-7(1959). (In Czech.)

The type and extent of hazards associated at present with work with radioluminescent substances were investigated. Comprehensive methods were used which made it possible to obtain a direct relationship between the type and amount of radioactive substance and the hazard to the health of the workers. The present work is the first report on an accurate investigation of departments working with radioactive substances. The result of these investigations is the immediate elimination of shortcomings, a better technical training of the workers involved (from the aspect of protection against radiation), and more detailed information regarding the types and extent of various hazards. New standards will be prepared to obtain optimal protection from ionizing radiation in the different industrial and other branches involved. (auth)

1727
PARTICULATE CLOUDS: DUSTS, SMOKES, AND MISTS. Their Physics and Physical Chemistry and Industrial and Environmental Aspects. H. L. Green and W. R. Lane. London, E. and F. N. Spon, Ltd., 1957. 448p.

A review of the physics and physical chemistry related to particulate clouds is presented. Included are sections devoted to cloud production, physical and optical properties, kinetics of particulate coagulation, deposition and filtration, sampling and estimation, and atmospheric diffusion. Discussions of environmental aspects such as health hazards, atmospheric pollution, and sample collection are also included. (J.R.D.)

1728
RADIOLOGICAL HAZARDS TO PATIENTS. Interim Report of the Committee. London, Her Majesty's Stationery Office, 1959. 22p. $0.17.

A survey was made of exposure to radiation produced by mass miniature radiography. Doses to the gonads were found to make a negligible contribution to the total radiation to which the population is daily exposed. Mass miniature x-ray examinations in 1957 led to the discovery of nearly 18,000 cases of pulmonary tuberculosis and some 63,000 other abnormalities which included lung cancer, heart disease, and pneumoconiosis. (C.H.)

ISOTOPE SEPARTION

1729 NYOO-85
THE IMPROVED DUAL-TEMPERATURE PROCESS FOR THE PRODUCTION OF HEAVY WATER (INCLUDING COST ANALYSIS AND PILOT PLANT PROGRAM). J. S. Spevack.

Oct. 25, 1949. Decl. July 27, 1959. 45p. Contract AT(30-1)-759. OTS.

An improved process for the production of heavy water at low cost by the Hydrogen Sulfide-Water Dual-Temperature Process is described and evaluated. Operating and construction costs are estimated for a full-scale plant to produce five tons of heavy water per month and a pilot plant to produce five hundred pounds per month. An engineering study program is presented. (auth)

1730

ISOTOPE SEPARATORS AND THE TRANSPORT EQUATION. G. Barvikh and R. Ya. Kucherov. Atomnaya Energ. 7, 275-6 (1959) Sept. (In Russian)

An equation describing isotopic transport in a separator was derived based on the approximation of small variations in separator cross section concentration. The derived formula was not adapted to special conditions of separation, special apparatus constructions, or character of flow, and is applicable to elementary separators as well as column-type apparatus with complicated configuration. (R.V.J.)

1731

SEPARATION OF OXYGEN ISOTOPES IN THE PROCESS OF ELECTROSYNTHESIS OF OZONE. I. A. Semiokhin, G. M. Panchenkov, V. K. Korovkin, and A. V. Borisov (M. V. Lomonosov Moscow State Univ.). Zhur. Fiz. Khim. 33, 1933-8(1959) Sept. (In Russian).

The separation of oxygen isotopes was accomplished by the method of chemical exchange under electrical discharge conditions. An apparatus was devised, convenient for determining the coefficient of once-through separation of the isotopes, and experiments were carried out of the multi-stage separation of oxygen isotopes in the electrosynthesis of ozone. The steady state in the isotope exchange between oxygen and ozone was shown to be established within one second. This bears evidence to the high rate of redistribution of the isotopes under electrical discharge conditions. The enrichment of the ozone in the ozonizer with O^{18} isotope practically does not depend on the ozonizer's length and on the methods of the ozone accumulation and of testing. Under one stage experimental conditions in reactors of different lengths with gas space 1 mm wide, the values of the coefficients obtained at 20°C and 750 mm Hg were found to be 1.08 to 1.10. (auth)

1732

PROCESS AND APPARATUS FOR THE SEPARATION OF ISOTOPES BY FRACTIONAL DISTILLATION. (to United Kingdom Atomic Energy Authority). British Patent 822,001. Oct. 21, 1959.

A fractional distillation apparatus for isotope separation is described. It consists of a stepped series of trays arranged so that vapor condenses on a sloping roof and flows by gravity to the next tray, and liquid in the tray overflows by gravity to the first tray. The space between tray and roof is evacuated. (T.R.H.)

MATHEMATICS AND COMPUTERS

1733 ANL-6039

Argonne National Lab., Lemont, Ill.

MATRICES FOR TRANSFORMING LEGENDRE POLYNOMIAL COEFFICIENTS BETWEEN LABORATORY AND CENTER OF MASS SYSTEMS. R. O. Lane, W. F. Miller, and K. E. Hillstrom. Aug. 1959. 70p. OTS.

The GEORGE computer at Argonne National Laboratory was coded to transform yields as well as the coefficients between the two systems. The matrices used in the transformation of coefficients are tabulated. (auth)

1734 JEN-38

Spain. Junta de Energia Nuclear, Madrid.

SIMULADOR DE UN REACTOR NUCLEAR. (Nuclear Reactor Simulator). Domingo Diez Serrano. 1958. 40p.

A reactor simulator for a natural uranium graphite reactor is described. The establishment of the reactor kinetic equations is briefly discussed. The calculation and construction of the simulator is then considered with detailed diagrams of the circuitry. The curves obtained with the simulator are given. (J.S.R.)

1735 LA-2314

Los Alamos Scientific Lab., N. Mex.

NUMERICAL METHODS FOR SOLVING LINEAR SYSTEMS AND APPLICATIONS TO ELLIPTIC DIFFERENCE EQUATIONS. C. E. Lee and P. M. Stone. Sept. 1958. 97p. Contract W-7405-eng-36. OTS.

Iterative numerical methods for solving independent, simultaneous, inhomogeneous linear equations are surveyed. Application of the methods to elliptic difference equations as arise in neutron diffusion, heat conduction, and potential problems is discussed. (auth)

1736 NP-8002

Lockheed Nuclear Products, Marietta, Ga.

A FOIL ACTIVATION ANALOG COMPUTER. L. A. Turner, J. T. Bracken, and W. M. Cole. Sept. 1959. 28p. Contract AF33(600)38947. (NR-67).

Foil activation is frequently used in nuclear dosimetry as a means of accurately measuring neutron flux. A number of nuclear reactions, having different thresholds, may be used to obtain an approximation of flux and energy distribution. The determination of flux and energy distribution becomes a tedious mathematical problem when the radiation power level is not constant and when the half-lives of the radioisotopes formed are short in comparison with the time of exposure. To solve this problem, an analog computer was designed and constructed. Data are provided as a magnetic tape recording of reactor power. (auth)

1737 NP-8016

Nuclear Codes Group.

NEWSLETTER NO. 9. Sept. 1, 1959. 14p.

Compiled and distributed by New York Univ. Atomic Energy Commission Computing and Applied Mathematics Center.

Minutes of the business meetings held at Detroit on Dec. 8, 1958 and Gatlinburg on June 15, 1959 are presented in condensed form. A summary of a lecture on introduction to transport theory codes is given. Nuclear codes 470/RE112 (ANL), FAF, VAPOR, SPAR, SPOT, FINE, P3, POP (Vallecitos), and hydrogeneous shielding (Rolls-Royce) are summarized. (W.D.M.)

1738 WAPD-TM-176

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

SPAN-2 —AN IMB-704 CODE TO CALCULATE UNCOLLIDED FLUX OUTSIDE A CIRCULAR CYLINDER. P. A. Gillis, T. J. Lawton, and K. W. Brand. Aug. 1959. 44p. Contract AT-11-1-GEN-14. OTS.

The SPAN-2 code calculates the uncollided gamma flux at a point outside a right circular cylinder which is surrounded by cylindrical shell shields and above which are plane slab shields. The cylinder is assumed to contain a source of gamma radiation which varies in the radial and axial directions only. Field points may be located in a plane through the axis of the cylinder. The method of integration used is three-dimensional Gaussian quadrature. Typical computing and editing time for a 20 field point problem, in which there are 10 side and 10 top shields, is four minutes per energy level. A 32,768 word IBM-704 is required for the code. (auth)

1739 SCL-T-281
TABLES FOR FREQUENCY ANALYSIS WITH PRACTICAL APPLICATIONS. (Tafeln zur Häufigkeitszerlegung mit Anwendungsbeispielen). Oskar Essenwanger. Translated by Marcel I. Weinreich (Sandia Corp.) from Ber. deut. Wetterdienstes 5, No. 39, 1-13 + 13 appended tables (1957). 51p. JCL.

In a previous study, there was presented a detailed discussion of the theoretical bases for a method of analyzing a frequency distribution into normal curves. The solutions of the equations derived in the aforementioned work are compiled in the form of Tables. In addition, there are practical examples for carrying out analyses which elucidate the handling of the tables, pointing out various peculiarities which may occur during meteorological frequency distributions. The derivations which lead to the evaluation equations are listed. (auth)

1740
PROCEEDINGS OF THE THIRD ANNUAL COMPUTER APPLICATIONS SYMPOSIUM, OCTOBER 9-10, 1956. Chicago, Armour Research Foundation, Illinois Institute of Technology, 1957. 148p. $3.00.

A primary purpose of the symposium was to illustrate diversity among computing machines and among applications and to provide a true picture of medium-scale computer applications as existing today. Reports by users of various medium-scale computers were followed by round-table discussions emphasizing solutions to planning, installation, and operating problems. (W.D.M.)

1741
PROCEEDINGS OF THE FOURTH ANNUAL COMPUTER APPLICATIONS SYMPOSIUM, OCTOBER 24-25, 1957. Chicago, Armour Research Foundation, Illinois Institute of Technology, 1958. 134p. $3.00.

The sessions of the Fourth Annual Computer Applications Symposium stressed new areas of application, use of new computers and accessories, and recent developments in automatic programming. The various contributions illustrate the ever present diversity among computing machines, areas of applications, and techniques of utilization at industrial, academic, and governmental installations. (W.D.M.)

1742
PROCEEDINGS OF THE FIFTH ANNUAL COMPUTER APPLICATIONS SYMPOSIUM, OCTOBER 29-30, 1958. Chicago, Armour Research Foundation, Illinois Institute of Technology, 1959. 160p. $3.00.

The sessions of the Fifth Annual Computer Applications Symposium stressed the use of new computers and accessories, new techniques of computer programming, the organization and operation of computer installations, and new applications. Included for publication were the pertinent discussions which followed the scheduled talks in addition to the panel discussion which climaxed each day's session. (W.D.M.)

METALS, CERAMICS, AND MATERIALS

General and Miscellaneous

1743 AECU-4426
General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.
REFINING AND PURIFICATION OF RARE-EARTH METALS. C. L. Huffine and J. M. Williams. Nov. 3, 1959. 32p. OTS.

Presented at the ASM-AEC Symposium on the Rare Earths and Related Metals, Chicago, Ill.

Behavioral differences within the rare earth metal group are sufficiently pronounced to make generalizations in regard to purification of questionable value. In the few cases where the same technique has been applied to two members of the group, the results as often as not have been contradictory. Nevertheless, it would appear that those techniques which are generally most promising for purification of the rare earth metals are distillation and solid state electrolysis. Zone refining may be of value for some impurities, but the van Arkel—de Boer deposition technique appears to hold little promise. None of the techniques with the possible exception of amalgamation is particularly attractive as a production process, and it must be concluded that refinement of the reduction itself is the optimum method for obtaining a pure metal in quantity. A similar conclusion was reached in a recent theoretical survey of metal refining techniques. (auth)

1744 AECU-4448
Denver. Univ. Denver Research Inst.
THE DETERMINATION OF THE EQUILIBRIUM PHASE DIAGRAM, ZIRCONIUM—NIOBIUM. Charles E. Lundin. Nov. 5, 1959. 8p. Contract AT(11-1)-752. OTS.

Primary emphasis during the report period was placed on alloy button-ingots arc melting and on preparing these and previously alloyed materials for isothermal annealing. Melting of fill-in alloys continued. Arc-melting weight losses and as-cast hardness values for the buttons are tabulated along with data from chemical analysis. Also, data on thickness reduction obtained in cold pressing are included as well as data on reduction due to cold rolling. From these data comparative concepts of workability and ductility may be gained. (J.R.D.)

1745 AFMDC-TR-59-1
Battelle Memorial Inst., Columbus, Ohio.
A LITERATURE SURVEY OF THEORIES AND METHODS OF PREDICTING CHARACTERISTICS OF MATERIALS. Ervin E. Underwood, Maurice F. Amateau, Robert E. Maringer, and George K. Manning. Nov. 1958. 213p. Project 6886. Contract AF29(600)-1557. (AD-154109). OTS.

A literature survey of theories and methods relating to strength and plastic deformation of materials has yielded almost 1800 abstracted references from various publications appearing between 1930 and 1957 to 1958. Primary emphasis was given to dislocation theories; absolute reaction rate theories; thermodynamic theories of fracture strength; relationships based on equations of state; and empirical relationships and parameters. The evaluation of the most promising theories and methods indicates that dislocation-type theories, or the parameter-type expressions, offer the greatest opportunity for ultimately predicting strength properties. (auth)

1746 BM-IC-7881
Bureau of Mines.
CADMIUM—A MATERIALS SURVEY. Robert L. Mentch and Arnold M. Lansche. Apr. 1958. 47p. GPO.

Information on cadmium is given in terms of occurrence, reserves, recovery, properties, uses, compounds, substitutes, US and foreign supplies, industry operations, and government controls. Flowsheets for various US plants are included. (W.D.M.)

1747 BM-RI-5443
Bureau of Mines.
AIR-COOLED CRUCIBLES FOR COLD-MOLD ARC MELT-

ING. M. M. Kirk, P. C. Magnusson, and G. L. Schmidt. July 1958. 26p.

Forced-air cooling of cold-mold arc furnaces for melting zirconium and similar metals has been investigated and found to be practical from the standpoint of heat transfer. It is believed that this technique offers a significant reduction in explosion hazard from that inherent in water cooling, the current industrial practice. A copper crucible, with longitudinal, integral-type fins and with an outer jacket to confine the airstream, appears to be the best general design for air-cooled operation. Cutting the fins into short segments and bending the segments to produce a herringbone effect increased the airstream's turbulence and was found, on test, to increase the heat transfer up to 35%. A tentative examination was made of stainless steel and aluminum as potential crucible materials, but they were deemed unsatisfactory. (auth)

1748 BMI-1206
Battelle Memorial Inst., Columbus, Ohio.
PREPARATION, CLADDING, AND EVALUATION OF TITANIUM—BORON DISPERSIONS. Stan J. Paprocki, Donald L. Keller, Edwin S. Hodge, George W. Cunningham, Michael A Gedwill, and Donald E. Lozier. July 9, 1957. Decl. June 23, 1959. 37p. For Westinghouse Electric Corp. Bettis Plant. Contract NObs-67500, Subcontract 73-(00-793). OTS.

Powder dispersions of titanium—boron and titanium—boron carbide were prepared, clad, and evaluated for use as control materials. Compacts possessing up to 95 per cent of theoretical density were prepared by a hot-pressing technique. The relatively low temperature of 1500°F was used to obtain the desired high density. There was no visible reaction between the boron dispersant and titanium. Excellent metallurgical cladding of the titanium—boron dispersion with titanium was achieved by the use of both roll-bonding and gas pressure-bonding techniques. The rolling was performed at 1500°F and the pressure bonding was accomplished at 1600°F with a helium pressure of 10,000 psi for a time of 6 hr. The pressure-bonding technique produced a specimen with a more uniform boron dispersion and a better high-temperature-water corrosion resistance than were obtained through roll bonding. Extruded titanium—boron dispersions were joined to hafnium and clad with Zircaloy-2 by a roll-bonding technique to determine in a preliminary way the feasibility of preparing clad composite control rods. Strong, relatively ductile bonds were obtained between all of the components by the roll-bonding process and postfabrication heat treatment. (auth)

1749 CTR-319
Office of Technical Services, Washington, D. C.
CERMETS, 1940—59. Catalog of Technical Reports. 4p. OTS.

A reference list on cermets for the period 1940 to 1959 is presented. Information on how and where to obtain these reports is included. 112 references. (J.R.D.)

1750 CTR-344
Office of Technical Services, Washington, D. C.
ZIRCONIUM, 1932—58. Catalog of Technical Reports. 14p. OTS.

1751 CTR-365
Office of Technical Services, Washington, D. C.
URANIUM—PART I. URANIUM GENERAL, 1942—1958. Catalog of Technical Reports. 16p. OTS.

1752 DMIC-46G
Illinois Inst. of Tech., Chicago. Armour Research Foundation.
DEPARTMENT OF DEFENSE TITANIUM SHEET-ROLLING PROGRAM. TIME-TEMPERATURE-TRANSFORMATION DIAGRAMS OF THE TITANIUM SHEET-ROLLING-PROGRAM ALLOYS. [Period covered]: June 9, 1958 to June 15, 1959. L. E. Tanner. Oct. 19, 1959. 79p. ARF Project No. 2150. For Battelle Memorial Inst., Defense Metals Information Center. Contract AF18(600)-1375, Subcontract No. 58-9. (ARF-2150-6; PB-151075). OTS.

The titanium alloys Ti-2.5Al-16V, Ti-4Al-3Mo-1V, Ti-6Al-4V, and Ti-13V-11Cr-3Al are being evaluated in the Department of Defense Titanium Sheet-Rolling Program. To assist in the determination of optimum heat treatments for these alloys, the kinetics of their transformations were studied for two heat-treatment cycles, and TTT diagrams were constructed. The TTT diagrams resulting from each heat-treatment cycle are shown on the following pages accompanied by a description of the important mechanistic features of the transformations of each alloy. (auth)

1753 DMIC-Memo-35
Battelle Memorial Inst. Defense Metals Information, Center, Columbus, Ohio.
PROCEDURES FOR ELECTROPLATING COATINGS ON REFRACTORY METALS. John G. Beach and John A. Gurklis. Oct. 9, 1959. 27p.

A partial selection of procedures that have been employed to electroplate various metals onto refractory metals in an attempt to produce sound, adherent electroplates on the metals is given. Refractory metals included are vanadium, niobium, tantalum, tungsten, titanium, and molybdenum. (auth)

1754 FFA-36
Sweden. Flygtekniska Försöksanstalten, Ulvsunda.
ON THE STRESSES AT THE EDGE OF AN ECCENTRICALLY LOCATED CIRCULAR HOLE IN A STRIP UNDER TENSION. Sverker Sjöstrom. 1950. 29p.

The stress concentrations in a strip under tension containing an eccentrically located hole were examined. The problem has been worked out in connection with an investigation concerning stress concentrations at the edge of rivet holes in stringers. The starting point for the problem solution is the Airy stress function for the stresses in an infinite plate under unidirectional tension containing a circular hole. An auxiliary stress function is then determined by means of the Fourier integral theorem so that the stresses on the straight edges vanish. This auxiliary stress function introduces stresses on the edge of the hole which in turn are cancelled by another stress function, which introduces stresses on the straight edges. Going on in this manner it is possible to make the remaining stresses on the edges arbitrarily small provided the procedure converges. From a practical point of view the procedure converges fairly rapidly when the diameter of the hole is less than the distance between the neighboring edge and the center of the hole. (auth)

1755 HW-61846
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
ZIRCONIUM TUBE RUPTURE FROM LOCALIZED OVERHEATING. P. M. Jackson. Sept. 9, 1959. 9p. Contract [AT(45-1)-1350]. OTS.

Results of burst tests on Zircaloy-3 tubing are presented for temperatures at 500 to 650°F and pressures at 1500 to 2500 psi, and for Zircaloy-2 tubing at 600°F and 1500 psi. Test procedures are given and results are tabulated. (J.R.D.)

1756 KAPL-2056
Knolls Atomic Power Lab., Schenectady, N. Y.
EVALUATION OF BY-PRODUCT ZIRCALOY-2 CHIPS

USED FOR METAL POWDER PRODUCTION. R. N. Honeyman and E. O. Porter. Aug. 1, 1959. 17p. Contract W-31-109-Eng-52. OTS.

Zircaloy-2 chips were obtained from several different machining operations to determine which type of chip, if any, would be most suitable for hammer-milling into powder that would meet the requirements of KAPL Specification O-KPM 3-42, Revision 4. Those chips made on a rise-and-fall milling machine to a thickness of 0.001 to 0.003 in. proved to be the most satisfactory; 96% were converted to powder of −60 mesh size by means of only two passes through a hammer mill. Since these chips are by-products obtained when other parts are machined, the powder produced from them can be expected to cost less than the powder made by present mechanical attritioning techniques. (auth)

1757 MSAR-59-117
MSA Research Corp., Callery, Penna.
PROGRESS REPORT NO. 54 FOR AUGUST AND SEPTEMBER 1959. W. J. Posey, ed. Oct. 16, 1959. 50p. Contract NObs-77023.

Work continued on film boiling with water inside tubes. Sodium silicate was used in combination with insulating materials to investigate its usefulness as an inhibitor to chloride stress corrosion. The corrosion specimens were 1-in. Sch 40 Type 304 stainless steel pipe which were stressed, insulated and thermally cycled from ~200 to 650°F by periodic heating and emersion in sea water. Stressed, uninsulated 1-in. Sch 40 Type 304 stainless steel pipe specimens were exposed to a high humidity simulated sea water—air environment for a 1000 hr period to investigate the occurrence of chloride stress corrosion. The purpose of the BTF Pressurizer Blowdown Test was to obtain vessel blowdown data to establish that the specific application of the mathematical model used to describe the reactor blowdown is conservative for the size of the pressure vessel. The pressure buildup in the vapor container during loss of coolant accident in a reactor is being studied. The reaction rates of sodium sulfite and dissolved oxygen in boiler water and feed water are being studied as a function of temperature, oxygen concentration, sulfite concentration, phosphate concentration, pH, and copper concentration. Potassium pentaborate is being considered as a chemical poison to reactor shutdown. (For preceding period see MSAR-59-89.) (W.L.H.)

1758 NAA-SR-Memo-2999
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
TEST RESULTS—SRE INPILE POISON RING TEST NO. 1. S. Arneson. Aug. 15, 1958. 14p. OTS.

Temperatures in an SRE type control rod were measured at power levels up to 20.1 Mev. The maximum temperature observed at this power was 1363°F at the lower end of the pull tube. The maximum temperature difference between coolant and rod was 473°F. The temperatures along the thimble did not follow the predicted pattern, but showed reasonably good internal consistency. The thermal neutron flux near the rod varied from 1 to 2 × 10^{12} n/cm^2—sec at about 5.6 Mev. The B_4C ring proved to be a much more effective neutron absorber than did the boron nickel alloy ring. (W.L.H.)

1759 NAA-SR-Memo-4209
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
PROPOSED EXPERIMENTAL APPARATUS DESIGN AND PROCEDURES FOR VAPOR PHASE PLATING. J. Bodine. July 31, 1959. 36p. OTS.

It has been proposed to clad U-10 wt.% Mo and other reactor fuels with Mo, Cr, and/or other metallic films by vapor phase plating. An apparatus was designed for plating U-10 wt.% Mo fuel slugs $^3/_4$-in. diameter by 6-in. long, by thermal decomposition of a metal carbonyl. The first trial of the experimental investigation will be the plating of Mo from its carbonyl, Mo(CO)$_6$. (W.L.H.)

1760 NP-7993
Emerson and Cuming, Inc., Canton, Mass.
DIELECTRIC EMBEDDING MATERIAL FOR 500°C SERVICE. Final Report for June 13, 1958 through June 12, 1959. Angelo H. Rossetti. 54p. Contract NObs-72441.

An experimental study was conducted in the development of an ultra high-temperature dielectric material for embedding electronic circuits. Several commercially available refractory castables chosen on the basis of their cold set characteristics were tested. Generally, they were easily fabricated and showed negligible shrinkage. Strength was poor, however, and this fact coupled with high porosity and sensitivity of the bond to moisture were sufficient to cause disqualification of this group of materials. Bonding proved to be the biggest problem. Various inorganic fillers were compounded with the known inorganic binders and evaluated. The best over-all physical and electrical properties were obtained with normal fluorphlogopite synthetic mica bonded with silica sol. The mixture can be cast and dried slowly at temperatures no higher than 250°C and then be immediately capable of exposure to 1100°C. Modulus of rupture remained above 700 psi over the 500°C temperature range. Porosity is the main disadvantage. Attempts to eliminate it by impregnation, glaze coating or introduction or inorganic crystalline materials into the matrix were unsuccessful. Incorporation of low-melting glasses in the filler portion of the system appeared to offer the best practical solution to the problem. Several low-melting glasses were incorporated in the matrix. It was necessary, however, to use greater than 70 wt. % glass in the formulation in order to achieve a nonporous product. The vitreous bond subsequently produced by the molten glass gave a separate, ceramic-type material. In spite of the advantages, unfortunately, the glasses carry with them the large disadvantage of requiring high fabricating temperatures which are injurious to some electronic components. (auth)

1761 ORNL-1267
Oak Ridge National Lab., Tenn.
METALLURGY DIVISION QUARTERLY PROGRESS REPORT FOR PERIOD ENDING JANUARY 31, 1952. W. H. Bridges, ed. Aug. 28, 1952. Decl. Oct. 9, 1959. 163p. Contract W-7405-eng-26. OTS.

Progress is reported on the following projects: Th alloy development, mechanical properties of Th, tensile properties and preferred orientation of Th, triple-dip slug canning, texture studies, fundamental studies of alloying, static corrosion tests with low melting point alloys, dynamic corrosion testing of fluoride materials, mass transfer, structures of liquid Pb and liquid Bi, fabrication of tubular laminates for fuel elements, creep of Th, cone-arc welding, Homogeneous Reactor Experiment metallurgy, a low-temperature specimen holder for use with the high-angle x-ray spectrometers, metallography of Zr and its alloys, automatic polishing machine, a fuel element manufacturing process for the direct-cycle aircraft reactor, and fabrication of fuel and control rod elements for the MTR. (L.T.W.)

1762 ORNL-2349
Oak Ridge National Lab., Tenn.
AIRCRAFT REACTOR EXPERIMENT— METALLURGICAL

ASPECTS. W. D. Manly, G. M. Adamson, Jr., J. H. Coobs, J. H. DeVan, D. A. Douglas, E. E. Hoffman, and P. Patriarca. Jan. 9, 1958. Decl. Oct. 9, 1959. 57p. Contract W-7405-eng-26. OTS.

The selection of the proper structural material to be used in the construction of an Aircraft Reactor is influenced by a number of important requirements. The material must have an acceptable cross section, be resistant to elevated-temperature corrosion by liquid metals, air, and the molten salts, and be free of temperature-gradient mass transfer. It must possess good creep properties in these environments and be free of structural changes during service. Finally, it must be easy to form and weld into relatively complicated shapes and be commercially available. Inconel was selected as the structural material for the Aircraft Reactor because it met these requirements. The experimental work performed in the fields of corrosion, creep, and welding is described. Although a small amount of corrosion in the salt and some mass transfer in both sodium and salt were observed, the material performed quite satisfactorily during the lifetime of the reactor. The creep properties of Inconel were adversely affected by the various environments; however, by designing to limit the stress, successful operation of the reactor was achieved. Both the successful operation of the reactor and the relative ease with which a multitude of welded joints in the plumbing circuit was produced attested to the weldability of this alloy. (auth)

1763 ORNL-2422(Del)
Oak Ridge National Lab., Tenn.
METALLURGY DIVISION ANNUAL PROGRESS REPORT FOR PERIOD ENDING OCTOBER 10, 1957. Dec. 13, 1957. Decl. with deletions Oct. 29, 1959. 247p. Contract W-7405-eng-26. OTS.

High-Temperature Metallurgy. A series of Inconel loops were operated to study the variation with time of depth of corrosion, effect of flow rate on corrosion, and effect of temperature drop on corrosion using fused salts. The corrosive effects of fused salts on Hastelloy B and Ni–Mo alloys are discussed. A series of Inconel–Na and Inconel–NaK forced circulation loops was operated to study the mass transfer in the systems. The mass transfer between Na and forced circulation loop of stainless steel, Incoloy, and Hastelloys B and W is discussed. Thermal convection loop corrosion resistance studies of Ni–Mo alloy, Inconel castings, and Nb in various systems are presented. Nondestructive testing methods and equipment are discussed. Methods and equipment used in the inspection of materials for reactor service are presented. A distillation apparatus is described for the purification of Na. To determine the effect of concentration on the diffusion coefficients, study on the rate of diffusion of Ni in liquid Pb was initiated. A study is reported to determine why the protective oxide layer of Ni, Ta, and Zr becomes disrupted. A brief survey was made of the microtopography of sulfide films formed on Nb, Ta, and Zr. A research program was undertaken to determine the effect of reactor radiation on the gaseous oxidation of metals. Measurements of the density and absorption spectra of fused salts are presented. HRP Metallurgy. Microstructures of aged quench-and-reheat specimens of Zr–Nb alloys are presented. The effect of H_2 on the embrittlement of Ti is given. Tensile and impact specimens of Zircaloy-2 were irradiated in corrosion loops to determine if any harmful mechanical property changes occurred through neutron irradiation or as a result of environment. Applied Metallurgy. Substitution of type 347 stainless steel for type 304 in APPR fuel elements because of heat-treatment specifications is discussed. An investigation was initiated to develop a dispersion of Eu_2O_3 in an iron-base material, clad with stainless steel as a replacement for boron-bearing absorber sections. The fabrication and composition of various reactor fuel materials are described. Treatment of various fuel materials by carburization is presented. Results of experiments on the intergranular diffusion of Zr by Mg are presented. Metallographic examinations of HRP reactor components are presented. Progress and status of development of polishing techniques for metallographic specimens employing vibratory polishing machines are presented. The microstructure of Inconel was investigated. Preparation and identification of some rare earth silicides are discussed. The diffusion of Ca in TiO_2 was studied. A preliminary investigation was made of the ThO_2–SiO_2 system. The electric arc calcination of ThO_2 is described. Fundamental Metallurgy. The allotropic modifications in metallic Ce are described. Preferred orientation in extruded Al rod is described. Low-temperature measurements of the specific heats of Zr and Zr–In alloys are presented. Phase studies of the Cd–Zr alloys are presented. Structures and phase transformations in Perovskite-type compounds are presented. (See also ORNL-2217.) (W.L.H.)

1764 SCTM-96-59(81)
Sandia Corp., Albuquerque, N. Mex.
CATHODIC VACUUM ETCHING VIA ION BOMBARDMENT. J. P. Darginis. Oct. 1959. 18p. Contract AT(29-)-789. OTS.

Cathodic vacuum etching by ion bombardment is an aid to producing clean protective surfaces for metallurgical examination, x-ray-diffraction specimen preparation, electron microscopy replication, and uranium precoat treatment. (auth)

1765 TID-3532
Technical Information Service Extension, AEC.
GRAPHITE. A Literature Search. Theodore F. Davis, comp. Oct. 1959. 82p. OTS.

A literature search on reactor graphite is presented, which also includes references to reports on the manufacture and uses of graphite in other fields. The bibliography includes 712 references from the report and published literature. (J.E.D.)

1766 USBM-U-476
USBM-U-494
Bureau of Mines. Northwest Electrodevelopment Experiment Station, Albany, Oreg.
PRODUCTION OF HIGH PURITY YTTRIUM. Monthly Progress Reports [for] July 1 to September 1, 1958. Changed from OFFICIAL USE ONLY July 31, 1959. (July 1–Aug. 1 (USBM-U-476). 9p.; Aug. 1–Sept. 1 (USBM-U-494). 13p.). Contract AT(11-1)-599. OTS.

These two reports were issued separately, but are cataloged as a unit.

The preparation of pure anhydrous yttrium compounds, lithium and calcium reduction of yttrium chloride, electrofining of yttrium, corrosion tests, and revision of free energy calculations are reported. (W.L.H.)

1767 USBM-U-647
Bureau of Mines. Albany Metallurgy Research Center, Oreg.
QUARTERLY METALLURGICAL PROGRESS REPORT NO. 4 FOR THE PERIOD JULY 1, 1959 TO SEPTEMBER 30, 1959. 33p. Contract AT(11-1)-599. OTS.

Experimental work on the purification of Th included the chlorination of calcined thorium oxalate, purification of crude $ThCl_4$ by double vacuum distillation, and the reduction of the purified chloride with reactor-grade Na metal.

Research on the preparation of high-purity Hf is reported. A series of Hf–Ta alloys was prepared as arc-melted buttons. A phase diagram for the system Ti–Gd was established. Investigations on the Ti–Ir system include the completion of liquidus-solidus determinations for alloys over the composition range 100 to 5 at.% Ti and the remainder Ir. Investigations were initiated to determine an equilibrium diagram for the Ti–Eu system. The construction of an equilibrium diagram for the Zr–Gd system is virtually completed. Research to develop new ways of preparing high purity Y metal during the past quarter largely centered on the operation of pilot plant equipment for the preparation of larger quantities of Y metal. Small scale work was continued involving the preparation of YCl_3 by direct chlorination of yttrium oxalate and the preparation of YI_3 by direct iodation of Y or yttrium carbide. (For preceding period see USBM-U-623.) (W.L.H.)

1768 WAPD-BT-15
Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh.
BETTIS TECHNICAL REVIEW. REACTOR METALLURGY. Sept. 1959. 124p. Contract AT-11-1-GEN-14 and appropriate NObs-Contracts. OTS.

Ten papers are presented on reactor metallurgy. Separate abstracts have been prepared for nine of these papers. (W.L.H.)

1769 WAPD-BT-15(p.1-39)
Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh.
DEVELOPMENT AND PROPERTIES OF SILVER-BASE ALLOYS AS CONTROL ROD MATERIALS FOR PRESSURIZED WATER REACTORS. I. Cohen and J. D. Eichenberg. 39p.

One of the most promising groups of control rod materials for replacing scarce and expensive hafnium in pressurized water reactors is the Ag-base alloys. A detailed investigation of the properties of the Ag-15 wt.% In-5 wt.% Cd alloy has been underway for some time. The results of that investigation indicate the alloy is satisfactory in nuclear and mechanical properties, wear resistance, irradiation stability, and fabricability and is marginal in corrosion resistance in high oxygen and creep resistance against bending loads. (auth)

1770 WAPD-BT-15(p.50-60)
Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh.
THE EFFECTS OF MECHANICAL AND THERMAL PROCESSES ON SOME PHYSICAL CHARACTERISTICS OF UO_2 POWDERS. J. C. Clayton and S. Aronson. 11p.

The effects of various comminution procedures as well as thermal treatments on the physical characteristics of several UO_2 powders were studied. Grinding the uranium oxide particles increased the total surface area and decreased both the particle size and bulk density. Heating both coarse and fine UO_2 powders at elevated temperatures resulted in particle growth, a decreased surface area, and an increase in fluid density. (auth)

1771 WAPD-BT-15(p.61-74)
Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh.
EVALUATION OF VACUUM-CAST ZIRCALOY-2 CORE STRUCTURAL MEMBERS. L. S. Rubenstein and C. V. Zabielski. 14p.

As part of the over-all program to reduce the cost of core components, vacuum casting of Zircaloy-2 was investigated. Corrosion, tensile, and impact properties as well as surface finish, dimensional reproducibility, chemical homogeneity, and soundness of test specimens were evaluated. Results showed that with proper process control vacuum cast support members are comparable with wrought products. (auth)

1772 WAPD-BT-15(p.75-86)
Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh.
FRETTING CORROSION OF ZIRCALOY. W. D. McMullen, J. J. Kearns, L. P. Morgan, and T. Webster. 12p.

The fretting of Zircaloy against Zircaloy and of Zircaloy against stainless steel is examined in test environments of air, oxygen, and water. Theoretical considerations are given for the results at hand. Indications are that the oxide film formed on Zircaloy is beneficial and its removal or partial removal is detrimental. (auth)

1773 WAPD-BT-15(p.87-94)
Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh.
ELIMINATION OF COPPER CONTAMINATION IN ZIRCALOY-2 WELDING. B. W. Schaaf, W. L. Frankhouser, and P. Ruzicka. 8p.

Copper weld backups, used in the welding of Zircaloy core components, tend to contaminate the weld area and reduce the corrosion resistance of the component. A three-phase program designed to eliminate this contamination is described. It was found that Zircaloy-2 backups were the most satisfactory substitute for copper and that, with certain weld geometries, backups can be successfully eliminated. (auth)

1774 WAPD-BT-15(p.95-8)
Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh.
THE MEASUREMENT OF METAL AND WATER SPACE VOLUMES IN PRESSURIZED WATER REACTOR COMPONENTS. J. M. Dickson, W. G. Kruper, M. Potoma, and L. H. Sherwin. 4p.

The increased importance of accuracy in the measurement of fuel subassembly metal and water space volumes has led to the design of a new unit for this purpose. The subassembly to be measured is immersed in the unit's water tank, and the change in water level is measured by moving an electrical probe into contact with the water surface. The unit can be used to measure selected portions of a component length and individual subassemblies within a cluster with a precision of ±0.28% or less. (auth)

1775 WAPD-BT-15(p.99-103)
Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh.
LOCATION OF RESIDUAL SPACER MATERIAL IN SUBASSEMBLIES. R. A. Betz. 5p.

The location of steel spacer material which has not been removed by pickling is one of the inspection problems encountered with fusion welded plate-type subassemblies. To circumvent certain disadvantages encountered with eddy-current techniques, a highly sensitive device was constructed to locate such material by detection of its magnetic field. This device has proven to be fast, sensitive, and specific in the detection and location of pieces of ferromagnetic material weighing only a few milligrams. (auth)

1776 WAPD-BT-15(p.104-8)
Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh.
WATER CHANNEL REPLICA PROBE. J. V. Filiaggi and J. M. Dickson. 5p.

The interpretation of panoramic inspection photos of cluster plate surfaces is difficult and time-consuming. A replica probe has been developed for making impressions of questionable areas of fuel plates for closer inspection. This probe, employing a thermosetting plastic, has been utilized to a limited extent in production-type inspection and has increased surety of interpretation without presenting major difficulties. (auth)

1777 WAPD-BT-15(p.109-16)
Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh.
AUTORADIOMETRIC METHODS OF DETERMINING URANIUM HOMOGENEITY AND TOTAL URANIUM CONTENT OF FUEL ALLOYS. H. H. Lang. 8p.

Two nondestructive autoradiometric methods of enriched uranium analysis have been developed. By one method, based on the measurement of local uranium concentration, it is possible to calculate total uranium content and homogeneity with an accuracy equivalent to that of the x-ray fluorescence method at a cost savings of $10 per fuel alloy ingot. The other method is used to determine total uranium content in cases where, due to gross inhomogeneity or other reasons, total loadings cannot be accurately calculated from the analysis of a few samples. (auth)

1778 WAPD-LSR(M)-11
[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh].
PRELIMINARY REPORT ON EVALUATION OF CARBON STEEL. H. F. Beeghly. May 1, 1955. Changed from OFFICIAL USE ONLY Sept. 12, 1956. 38p. Contract NObs-56404.

Loop corrosion tests on grade A212 carbon steel show that the corrosion rate becomes relatively low after an initial conditioning period. A rate of 50 mg/dm^2-mo seems realistic to use as a basis for reactor components and system design. The corrosion rate for a given water condition has a range of values. Of the conditions studied (PH 7 and PH 10 with and without hydrogen) no single condition produces a corrosion rate markedly superior to the others. It appears that choice of water conditions could be based on operating feasibility with reasonable assurance that the corrosion rate would not be affected. Such factors as fouling, localized attack, functioning of filters and lay-up during idle periods may ultimately dictate the water conditions necessary. The composition of carbon steel is such that fewer corrosion elements appear in the crud than from stainless steel. Of the elements recognized to be significant sources of short-lived radioactivity in the primary water, only manganese will corrode from carbon steel. Its corrosion rate must be two to three times that from type 347 SS to liberate an equal amount of manganese. The iron content of carbon steel crud will be higher than from 347 SS and chromium, nickel, and cobalt will be very much lower. Work on 0.10% manganese content carbon steels showed that these steels can be rolled with commercial equipment and practices into plate and seamless tubing. They meet ASTM specifications. Preliminary data indicate the grades are capable of meeting ASTM designation A302 also. Standard welding procedures can be used to join them to standard A212 and to 304 and 347 SS. Their corrosion rate is equivalent to that for carbon steel of normal manganese content. A reduction of manganese corrosion rate by a factor of 8 to 10 for carbon and of 15 to 25 over stainless steel might be realized by use of low manganese steel. Carbon steel is believed to be acceptable as a material of construction from the standpoint of materials, components and systems; its corrosion rate is low enough to make it usable from the standpoint of chemistry and materials. The designation of carbon steel as the reference material for a reactor design would facilitate its development. This is believed to be justified if cost estimates indicate a worthwhile economy can be realized from its use. From the standpoint of availability, and critical schedule requirements, use of carbon steel would be advantageous. (auth)

1779 WAPD-NCE-333-59
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
QUARTERLY PROGRESS REPORT OF THE TECHNOLOGY SECTION—SPECIAL MATERIALS SECTION FOR THE PERIOD OCTOBER 1 TO DECEMBER 31, 1958. Jan. 15, 1959. 30p. OTS.

The effect of oxygen on the transformation temperatures for Zircaloy-2 has been determined and is shown. The cold fabricability of Zircaloy-2 containing various levels of oxygen and with various heat treatments has been determined. The results are presented graphically. It was determined that the ductility decreased with increasing oxygen content, independent of heat treatment, and that specimens heated 20 hr at 750°C showed the best ductility. It was determined that cast Zircaloy-2 retains dimensional stability after thermal cycling three times at 600°F. Cold rolled Zircaloy-2 strip must be pickled a minimum of 0.0005-in. per surface to ensure corrosion resistance. Analysis of tensile data showed that 500°F properties cannot be predicted with any degree of confidence from room temperature values. A cursory study of critical grain growth in Zircaloy-2 showed largest grain growth to occur in specimens cold rolled 9% and annealed at 750°C for 8 hr. The heat treatment behavior of the nickel-free Zircaloy-2 specimens was similar to that of Zircaloy-2. (For preceding period see WAPD-NCE-666.) (auth)

1780 WAPD-NCE-666
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
QUARTERLY PROGRESS REPORT OF THE TECHNOLOGY SECTION—SPECIAL MATERIALS SECTION FOR THE PERIOD JULY 1 TO SEPTEMBER 30, 1958. Oct. 15, 1958. 30p. OTS.

The inclusions in Zircaloy-2 have been attributed to faulty welding procedures with carbon electrodes. The 28-day corrosion results for both 750°F steam and 680°F water tests of the impurity program coupons show only slight variations in weight gain. Silicon content of about 300 ppm in Zircaloy-2 apparently reduces the deleterious effects on the corrosion resistance of furnace-cooled material. Ingots of Zircaloy-2 containing up to 10,000 ppm O_2 can be forged. Temperature must be increased to about 1900°F for those ingots with greater than 5000 ppm O_2. Slabs containing up to 5000 ppm can be hot rolled. Slabs containing greater than 5000 ppm could not be rolled even at temperatures up to 1825°F. Tensile strength of Zircaloy-2 increase linearly with O_2 contents up to 10,000 ppm. Castings of Zircaloy-2 have been found to be suitable for reactor applications. Zircaloy-2 strip has been cold rolled commercially to tolerances of $\frac{1}{2}$ to $\frac{1}{3}$ of commercial tolerances. Zircaloy-2 cold-rolled strip can be slit to very exacting dimensions. (For preceding period see WAPD-NCE-9040.) (auth)

1781 AEC-tr-3289
KINETICS OF THE DIFFUSION OF RADIOACTIVE RARE GASES FROM SOLID SUBSTANCES AFTER IRRADIATION. RARE GAS DIFFUSION IN SOLIDS 2. W. Inthoff and K. E. Zimen. Translated from Trans. Chalmers Univ. Technol. Gothenburg, No. 176 (1956). 12p. JCL.

Diffusion kinetics for rare gases from solids are considered. Equations are given for the fractions of the radioactive gas in and outside the solid phase as a function of time for the case of spheres, cylinders, and rectangular parallelepipeds. An approximation for short times is derived for use in evaluation of such diffusion experiments. The boundary effect by the recoil during irradiation is considered as well as the boundary effect by diffusion at room temperature before measurement. (auth)

1782 IG-IS-59(RD/S)
BERYLLIUM. P. Vachet. Translated by R. L. Tams (U.K.A.E.A., Risley) from Chim. & ind. (Paris) 81, 64-77 (1959). 15p.

A review of the chemical and physical properties of Be is presented. Extraction processes are described along with preparation of Be metal. Information on casting and aspects of working are included as well as information on properties and uses of oxides and alloys. (J.R.D.)

1783 JPRS-TR-L-575-N
PROTECTIVE COATINGS OF HEAT RESISTANT ALLOYS. V. A. Parfenov. Translated from Metalloved. i Obrabotka Metal., No. 6, 33-7(1958). 7p. OTS.

The effects of chrome electroplating and enameling on heat resistant alloys at 750 to 800°C were investigated. It was found that deposition of a 0.1 to 0.2 mm thick layer of chrome on the tested heat resistant alloys increases their endurance limit at 750 to 800°C by 14 to 16%. The electroplated layer recrystallizes at 800°C, therefore, the use of Cr as a protective coating is not recommended for units designed to operate at 800°C or above. Enameling also increases the endurance of heat resisting alloys by about 15%. Roasting temperature of enameled units should be decreased to increase the efficiency of enameling. (J.R.D.)

1784 NP-tr-309
PRINCIPLES OF PRODUCTION OF GAS FILLED PLASTICS AND ELASTOMERS. (Osnovy Proizvodstva Plastmass i Elastomerov). A. A. Berlin. Translated from a publication of the State Publishing House of Scientific-Technical Chemical Literature, Moscow, 1954. 219p. OTS.

The principles of gas-filled plastics and elastomers are discussed. Included are discussions and data on materials with cellular structure, materials with porous structure, honeycomb plastics, and gas-filled fibrous plastics. Characteristics and applications are emphasized. (J.R.D.)

1785
SOME ASPECTS OF QUALITY CONTROL IN FUSION-WELDED PRODUCTS. B. K. Barber (John Thompson Ltd., Wolverhampton, Eng.). Brit. Welding J. 6, 480-7(1959) Oct.

A review is given of the methods used in ensuring high quality in fusion-welded products. The use of radiography in non-destructive testing is discussed. The value of training schools for both welding operators and supervisors is discussed. The use of the correct welding procedures, choice of design, process, equipment, and electrodes are shown to play an important part in quality control. (C.J.G.)

1786
STUDIES OF LIQUID METALS. Bull. inform. sci. et tech. (Paris) No. 31, 63-77(1959) July-Aug. (In French)

Studies of the Societe des Metaux liquides related to the use of liquid metals in reactors are described. The studies include electromagnetic and mechanical pumps, heat exchange measurements, liquid level measurement, and installation of a sodium cooling system for a reactor and production of superheated vapor. (T.R.H.)

1787
ALLOYS OF THE BORON CARBIDE—MOLYBDENUM DISILICIDE SYSTEM. G. V. Samsonov, V. S. Sinelnikova, and P. S. Kislyi (Inst. of Metals and Special Alloys, Academy of Sciences, Ukrainian SSR). Dopovidi Akad. Nauk Ukr. R.S.R. No. 8, 866-8(1959). (In Ukrainian)

Properties of the boron carbide—molybdenum disilicide alloys were investigated by the methods of metallography, x-ray patterns, conductivity, and thermal emf. Formation of the quadripartite phase of variable constitution, like Nowotny phases $Mo_x(B_1C_1, Si)_y$, is found, with a very wide homogeneous region across which (from 10 to 50 mole % $MoSi_2$ in alloys with boron carbide) electrical resistivity increases and thermal emf decreases, in accordance with the degree of defectiveness of the lattice of this phase. The quadripartite compound is shown to be highly resistant against oxidation. (auth)

1788
THREE ANOMALIES IN THE PROCESS OF CHROMIUM ELECTRODEPOSITION. A. T. Vagramyan and D. N. Usachev (Inst. of Physical Chemistry, Academy of Sciences, USSR). Izvest. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk No. 7, 1207-10(1959) July. (In Russian)

Three anomalies were observed in chromium deposition in the presence of sulfuric acid. The reduction of Cr^{6+} to Cr^{3+} proceeds at a faster rate with low potentials and is considerably slowed by high potentials. With low potentials the mixing of electrolyte depresses cathode polarization while with high potentials it does not produce any effects. With an increase of electrode potential, at certain intervals, polarizing current drops instead of rising. It is assumed that the observed anomalies are related to the skin formation on the electrode surface. (R.V.J.)

1789
A STUDY OF THE IODIDE NIOBIUM PROCESS. Robert F. Rolsten (E. I. du Pont de Nemours & Co., Gibbstown, N. J.). J. Electrochem. Soc. 106, 975-80(1959) Nov.

It was established that the rate of deposition of niobium by the thermal decomposition of niobium iodides can be expressed in units of moles of niobium deposited per unit length of a deposition element per unit of time. The rate of deposition of niobium was studied (a) with deposition temperatures from 750 to 1100°C, (b) with feed material temperatures from 240 to 470°C, and (c) with crude niobium with different surface areas. (auth)

1790
ANALYSIS OF NON-METALLIC INCLUSIONS IN STEEL. H. Bizouard and J. Philibert. Rev. mét. 56, 123-4(1959) July. (In French)

The usefulness of a micro-drill with a spectrometer especially designed for light elements is demonstrated by a study of non-metallic inclusions in steels. The results of a study of inclusions found in some steels are presented and discussed briefly. (T.R.H.)

1791
EFFECTS OF VARIOUS TRACE ELEMENTS ON THE FORGEABILITY OF STEEL. C. Rossard and P. Blain. Rev. mét. 56, 175-80(1959) Aug-Sept. (In French)

The effects of small amounts of As, Cu, and Sb on hot deformation of steel were studied at 900 to 1200°C, torsion rates of 1 to 1000 bends/min and deformation velocities of 0.3 to 300%/sec. The effect is unfavorable and is especially evident with Sb and at high temperatures with Cu. The Cu effect manifests itself at concentrations near those found in practice. For As the effect is always slight. In one case the As seemed to improve forgeability at 1200°C. An interaction between Cu and As is suspected. No mechanism for the effects of these oligo-elements on forgeability is offered, but an effect on recrystallization phenomena is indicated. (T.R.H.)

1792
EFFECTS OF TRACE ELEMENTS ON THE RESILIENCE OF LOW-ALLOY STEELS HARDENED AND TEMPERED.

J. M. Capus (Mond Nickel Co., Ltd., Birmingham, Eng.). Rev. mét. 56, 181-9(1959) Aug.-Sept. (In French)

A study is described of the effects of additions of As, Mn, P, Sb, and Sn on the embrittlement at 350°C of very-pure-base Ni - Cr and Ni - Cr - Mo steels. It was found that the Ni - Cr - Mo steels were insensitive to embrittlement at 350°C as indicated by resilience tests at room temperature and -78°C and by determination of transition temperatures of samples tempered at a wide range of temperatures. The embrittlement is directly related to the effects of maintenance at 450°C. (T.R.H.)

1793

TRANSFORMATIONS IN α-SOLID SOLUTIONS OF Ag—Cd ALLOYS. V. N. Pyatnitskiĭ, A. T. Grigor'ev, E. M. Sokolovskaya, and E. V. Lysova (Lomonosov Moscow State Univ.). Zhur. Neorg. Khim. 4, 2039-42(1959) Sept. (In Russian)

Differential thermal analysis and hardness measurements of silver—cadmium α-solid solution uncovered transformations which are explained by formation of chemical compounds Ag_2Cd and Ag_3Cd. The nature of transformations with 4 to 8 at. % Cd is under investigation. (R.V.J.)

1794

SYMPOSIUM ON ADVANCES IN ELECTRON METALLOGRAPHY. Presented at the Sixty-first Annual Meeting, Boston, Mass., June 24, 1958. ASTM Special Technical Publication No. 245. Philadelphia, American Society for Testing Materials, 1958. 124p. $4.00.

The papers presented at the symposium include: Techniques Employed in the Electron Microscope Study of Ti Alloy with 8% Mn; Vibratory Polishing of Metallographic Specimens for Optical and Electron Microscopy; A Technique for Easy Removal of Direct Replicas for Electron Microscopy; Examination of Metals by Transmission Electron Microscopy; A Study of Dislocations in Thin Al Foils Elongated in the Electron Microscope; Microstructure of Age-Hardenable Alloys; An Electron Metallographic Study of the Precepitation-Hardening Process in Commercial Ni-Base Alloys; The Application of Electron Diffraction and Electron Microscopy in Studies of Minor Phases of Heat-Resisting Alloys; Electron Probe Analysis of Segregation in Inconel; and Selected Etchants for Electron Microscope Studies of Mg Alloys. (W.L.H.)

1795

VOPROSY FIZIKI METALLOV I METALLOVEDENIYA. (Problems in the Physics of Metals and Metallography). V. L. Shkurko, M. I. Yefimova, V. N. Svechnikov, S. D. Gertsriken, and I. Ya. Dekhtyar, eds. Kiev, Izdo-vo AN Ukrainskiy SSR, 1959.

A collection of articles dealing with effects of high-speed heating, heat treatment, deformations, and crystallization conditions on phase transformations, structures, and properties of metals and alloys is presented. The effects of additional alloying components on volumetric and intercrystalline diffusion in alloys are also discussed along with the effects of repeated quench hardening, and radioactive and ultrasonic treatment on the physical properties of alloys. (auth)

1796

VOPROSY FIZIKI METALLOV I METALLOVEDENIYA. SBORNIK NAUCHNYKH RABOT LABORATORII METALLOFIZIKI. NO. 3. (Problems of Metal Physics and Metallography. Symposium of Scientific Papers of the Laboratory on Metallography. No. 3). Kiev, Izdatel'stvo Akademii Nauk Ukrainskoi SSR, 1952. 183p.

The symposium includes articles on x-ray-diffraction analysis of carbide phases in steel, alterations in crystalline structure, effects of silicon, zirconium, cobalt, and chromium on the kinetics of martensite transformations, appearance of hydroquinone on the surface of calicite, zinc spar, and siderite crystals, kinetics of diffusion, and problems of metal physics of steel. 17 papers are included. (R.V.J.)

1797

OKHLAZHDENIYE METALLURGICHESKIKH PECHEY VYSOKTEMPERATURNYMI TEPLONOSITELYAMI. (Cooling of Metallurgical Furnaces by Means of High-temperature Heat Carriers). S. M. Lukomskii, ed. Moscow, Metallurgizdat, 1959. 228p.

Possibilities of the secondary utilization of heat as source of energy are investigated. Different types of high-temperature organic and inorganic heat carriers along with their properties and function in cooling metallurgical furnaces are discussed. Results of pilot plant tests carried out to analyze the process of cooling shaft furnace jackets using diphenyl mixture are analyzed. Various cooling systems using high-temperature heat carriers and their operations are described. Problems of heat emission and exchange, circulation of heat carriers suitable for cooling furnaces of various types, and the operation of cooling systems are reviewed. Some suggestions on how cooling systems should be operated are offered. (TCO)

1798

PROCEEDINGS OF THE SECOND UNITED NATIONS INTERNATIONAL CONFERENCE ON THE PEACEFUL USES OF ATOMIC ENERGY, HELD IN GENEVA, 1 SEPTEMBER—13 SEPTEMBER 1958. VOLUME 6. BASIC METALLURGY AND FABRICATION OF FUELS. Geneva, United Nations, 1958. 730p. $18.00.

The papers on physical metallurgy cover such subjects as the mechanical properties of U, Pu, and Th in the metallic state and of their alloys, alloy behavior, and the physical properties of alloys in various combinations. Several papers deal with radiation effects, including such aspects as the corrosion behavior of materials under irradiation. The fabrication of U fuels in the form of alloys, ceramics, or oxides is reported. There are six papers dealing with Pu fuels. (W.L.H.)

1799

VOPROSY TEORII KHROMIROVANIYA. (Problems in the Theory on Chromium Plating. Symposium of Reports Presented at Vilnyus Conference, October 2-3, 1958). Vilnyus, Lithuania, SSR, State Publishing House, 1958. 193p.

The symposium contains reports presented at the All-Union Conference on the Processes of Chrome Plating, in Vilnyus, Lithuania, Oct. 2-3, 1958. The reports are concerned with the theory and experimental data on chrome-plating mechanisms. 15 papers are included. (R.V.J.)

1800

IMPROVED ELECTROLYTIC PROCESS FOR PURIFYING TITANIUM, ZIRCONIUM OR HAFNIUM. (to Horizons Titanium Corp.). British Patent 823,125. Nov. 4, 1959.

Purification of Ti by electrolysis from the anode in a fused alkali metal halide salt bath containing alkali metal fluotitanate is described. To an electrolytic cell heated in Ar to 850°C is added NaCl (84 parts) then K_2TiF_6 (16 parts). The anode consists of the container, a perforated graphite barrier, and impure Ti chips. After inserting an Fe cathode, electrolysis was carried out at 910 to 935°C, 2.8 to 2.9 volts, cathode current density of 225 to 450 amps per dm^2, and anode current 34 to 39 amps per dm^2. The refined metal was very pure and had a Brinell hardness below

120. The Ti scrap in the anode may be tamped intermittently to squeeze out sludge formed. (T.R.H.)

1801

IMPROVEMENTS IN ELECTROLYTIC APPARATUS. (to Horizons Titanium Corp.). British Patent 823,126. Nov. 4, 1959.

An apparatus for continuous electrolysis of fused salts is presented. The device prepares electrolyte, carries out electrolysis, and provides for recovery of cathode deposit in such a way that contamination is avoided. It comprises a carbon-lined steel vessel in which electrolyte is melted up and purified. This vessel has a charging hopper, immersion-type heaters, thermocouples, an air-tight cover, and gas and exhaust manifolds. The charging hopper may be replaced by a cathode to purify the electrolyte. The molten electrolyte is passed to the electrolysis vessel through a graphite riser by inert gas pressure. The electrolysis vessel is similar to the first and has 3 compartments. The cathode is centered in the upper portion and is hollow for cooling. Feed metal to be purified is tamped in the lower portion as anode. The cathode deposit is removed after cooling by withdrawing the cathode through a knife-edge, the material being caught on a movable tray. (T.R.H.)

Corrosion

1802 BMI-1380

Battelle Memorial Inst., Columbus, Ohio.

HYDROGEN PICKUP DURING CORROSION OF ZIRCONIUM ALLOYS. Warren E. Berry, Dale A. Vaughan, and Earl L. White. Sept. 24, 1959. 19p. Contracts NObs-65057 (Affiliated with Contract W-7405-eng-92). OTS.

Several factors such as alloy composition, hydrogen content of the alloy, surface hydrides, and hydrogen content of the water have been investigated for their effect upon the amount of hydrogen picked up by zirconium alloys during corrosion in 680°F water. Metallic additions of nickel increase hydrogen pickup, antimony, chromium, and iron appear to decrease the hydrogen pickup, while the addition of tin has little or no effect. The hydrogen content of the metal (50 to 400 ppm) or of the water (0 to 2 atm of hydrogen pressure) does not appreciably change the amount of hydrogen picked up by the alloys studied. It is proposed that certain intermetallic compounds provide cathodic areas which aid in the concentration of hydrogen at the compound. The amount of corrosion-produced hydrogen entering the metal is controlled by the reaction of hydrogen with the particular compound. The hydriding of Zircaloy-2 by gaseous hydrogen is stopped when small quantities of water vapor are added to the hydrogen. (auth)

1803 MSAR-59-113

MSA Research Corp., Callery, Penna.

SODIUM SILICATE AS A STRESS CORROSION INHIBITOR. Technical Report 67. M. J. McGoff. Oct. 16, 1959. 18p. Contract NObs-77023.

Sodium silicate was used in combination with insulating materials to investigate its usefulness as an inhibitor to chloride stress corrosion. The corrosion specimens were type 304 stainless steel pipes which were stressed, insulated and thermally cycled at 200 to 650°F by periodic heating and immersion into sea water. It was observed that some of the sodium silicate treated, insulated specimens exhibited no stress corrosion after about 100 hr of thermal cycling whereas untreated specimens corroded in approximately 48 hr. The experimentation indicates that a water soluble inhibiting agent such as sodium silicate incorporated with insulation materials offers promise as a preventative technique to chloride stress corrosion. The time of protection is indefinite since the silicate appears to become spent with prolonged cycling. (auth)

1804 ORNL-1934

Oak Ridge National Lab., Tenn.

AN EVALUATION OF THE CORROSION AND OXIDATION RESISTANCE OF HIGH-TEMPERATURE BRAZING ALLOYS. Period covered: July 1954–September 1955. E. E. Hoffman, P. Patriarca, C. F. Leitten, Jr., and G. M. Slaughter. Nov. 7, 1956. Decl. Oct. 9, 1959. 40p. Contract W-7405-eng-26. OTS.

Many of the brazing alloys which were investigated were highly promising for sodium-to-air radiator service. Alloy systems of Ni–Si–B, Ni–Cr–Si–B, and Ni–Cr–Si were especially favorable. Precious-metal alloys were, in general, severely attacked by sodium, as were many of the silicon-free, chromium-free, phosphorus-bearing alloys. Alloys containing manganese, tin, or copper exhibited poor resistance to oxidation at 1500°F. In most cases, oxidation was more pronounced at 1700°F. For fused-fluoride-to-sodium heat exchanger service, the alloy systems Ni–Cr–P, Ni–Cr–Si–B, Ni–Si–B, and Ni–Ge–Cr–Si show promising corrosion resistance. Although the Ni–Cr–Si alloy was compatible with sodium, it was severely attacked by the fluoride bath. The binary alloy 88 Ni–12 P (alloy A-10) was incompatible with sodium but possessed good resistance to fluoride attack. Tests seem to indicate that complex alloy systems containing varying percentages of silicon and phosphorus as minor constituents may be compatible with both sodium and the fused salts, whereas the binary alloys exhibited compatibility with only one of these testing media. The only brazing alloys found to be compatible with fused sodium hydroxide were precious-metal alloys such as 82 Au–18 Ni. In evaluating the corrosion and the oxidation resistances of a brazing alloy for a specific application, emphasis was placed on the seesaw-corrosion and cyclic-oxidation studies, since these tests more nearly simulate the expected operating conditions than do the static tests. It must be remembered, however, that before a brazing alloy is selected for a given operation it should be tested further under the conditions which would closely simulate service conditions. (auth)

1805

EFFECT OF SILICON ON HIGH TEMPERATURE OXIDATION OF STAINLESS STEELS. John F. Radavich. Corrosion 15, 613t-17t(1959) Nov.

Growth of oxide films at 600 and 800°C on a series of 16 Cr-10 Ni-bal Fe stainless steels with silicon contents ranging from 0.17 to 3.55% was studied by electron microscopy, electron diffraction, x-ray diffraction, and x-ray fluorescence analysis. Oxide scales and sub-scales formed during oxidation at 1000°C were studied optically in cross section as well as by x-ray diffraction and fluorescence. Results show that as silicon content increases oxidation resistance increases rapidly until at the high silicon level, 3.55%, a very thin oxide film is formed at 600 and 800°C and very little oxide scale forms at 1000°C. Mechanism of oxidation resistance imparted by silicon appears to be that it decreases the number of defects in the initial oxide films formed at the metal-oxide interface. With a lesser number of defects in the thin film, an enrichment of Cr at the metal-oxide interface and in the oxide films occurs and the rate of diffusion of iron outward to form the oxide scale is greatly retarded. (auth)

1806

THIN FILM FORMATION ON ZIRCONIUM. Robert E.

Meyer (Oak Ridge National Lab., Tenn.). J. Electrochem. Soc. 106, 930-5(1959) Nov.

Using an electrochemical method, rates of film growth in oxygenated sodium sulfate solutions have been measured on polycrystalline zirconium at temperatures ranging from 25 to 88°C. The resulting rate-time plots are roughly hyperbolic. A model is proposed which when treated by electrode kinetics is shown to give this type of behavior. (auth)

1807
THE OXIDATION OF IRON—NICKEL ALLOYS. III. KINETICS OF OXIDATION OF THREE COMMERCIAL ALLOYS. R. T. Foley and C. J. Guare (General Electric Co., Schenectady, N. Y.). J. Electrochem. Soc. 106, 936-40 (1959) Nov.

Three commercial iron—nickel alloys, containing 30, 41, and 78% nickel, were oxidized over the range 600 to 1000°C in two atmospheres, laboratory air, and a 21.7% O_2–78.3% N_2 mixture. The oxidation of these alloys follows a parabolic weight gain-time relationship during the 60-min reaction time. Replicate experiments generally showed that the precision in determining the parabolic rate constants was better in the O_2-N_2 mixture than in laboratory air. This effect is probably the result of day-to-day variations in composition of laboratory air. Temperature dependences of the reaction rates were determined with the Arrhenius-type equation. Both the reaction rates and the apparent energies of activation of the 30-41% alloys are consistent with a rate-determining process of cation diffusion through a spinel structure $Ni_x\,Fe_{3-x}\,O_4$. It is hypothesized that the apparent energy of activation for the 78% alloy is due to the influence of the 3.8% Mo on the physical character of the film. Anomalously high rates were observed in both atmospheres at the higher temperatures, and this is discussed with reference to "over-temperatures," resulting from heat generated at the surface by oxidation. (auth)

1808
OXIDATION STUDIES ON THE NICKEL—CHROMIUM AND NICKEL—CHROMIUM—ALUMINUM HEATER ALLOYS. Earl A. Gulbransen and Kenneth F. Andrew (Westinghouse Electric Corp., Pittsburgh). J. Electrochem. Soc. 106, 941-8(1959) Nov.

A systematic study was made of the oxidation resistance of five 80Ni—20Cr heater alloys and one 4Al—19Cr—77Ni alloy. Kinetic and crystal structure studies were made over the temperature range of 500 to 1100°C. The adhesion of the oxide film to the alloy was tested by the strain oxidation technique, and the over-all performance was evaluated by the ASTM useful life tests. The rate of oxidation of the several alloys could not be correlated with the ASTM useful life results, while the strain oxidation tests could be correlated with the ASTM useful life tests. Cr_2O_3 was the major oxide formed on the 80Ni—20Cr alloys at 1100°C. Although Al_2O_3 and Cr_2O_3 were observed below 1000°C on the 4Al—19Cr—77Ni alloy, no Al_2O_3 was observed in the oxide scale at 1100°C. A thermodynamic and kinetic interpretation was made of the results. (auth)

1809
OXIDATION OF GRAPHITE IN REACTORS. M. Tomlinson (Atomic Energy Research Establishment, Harwell, Eng.). Nuclear Power 4, No. 43, 117-18(1959) Nov.

Seeming discrepancies in three graphite irradiation experiments are shown to arise because the oxidation rate is critically dependent upon the geometry of the system and the gas flow rate, as well as the more obvious parameters. When the differences in these parameters are allowed for, the results are seen to be consistent. Experiments were carried out in NRX, Windscale, and BEPO. (W.D.M.)

1810
EFFECT OF CORROSION ON FATIGUE OF METALS. Milorad Matejic. Zaštita Materÿala 5, 423-7(1957). (Translated from Referat. Zhur. Khim. No. 2, 1959, Abstract No. 5046).

Questions concerning the corrosion (C) of various metals and alloys under conditions of fatigue are discussed. The determination of ϑ_w of specimens of metals, which had preliminarily been exposed to C, yielded the following results depending on the kind of C. Uniform C did not affect the fatigue of a metal. Pitting noticeably decreased ϑ_w, as well as other mechanical properties. Intercrystallite C affects the fatigue very much. The determination of ϑ_w of specimens in the simultaneous action of the corrosion medium resulted in relations such as in the absence of O_2, a solution of sea water had a negligible effect on the decrease of ϑ_w of carbon steel. ϑ_w of many materials (steel containing 0.5% C, stainless steel with 0.12% C and 16% Cr, duralumin, pure annealed Cu, annealed brass, Pb) was greater in vacuo than in air. In the case of Pb, it was 2.24 times greater. The presence or absence of O_2 did not influence the magnitude of ϑ_w only in the case of alloys of Mg with 2% Al. ϑ_w increased in dry air. It is assumed that the influence of the atmospheric C on the fatigue of metals is caused by the catalytic action of water in the presence of O_2. An explanation of the mechanism of destruction in consequence of the corrosion fatigue is offered. The most effective methods of portection of various steels from C in sweet water and from the decrease of ϑ_w connected with it include electrolytic coating, nitriding, coating with plastics and addition of 0.02% Na_2Cr_2O— to the water.

Fabrication

1811 AECU-4425
General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.
MECHANICAL FABRICATION OF RARE EARTH METALS. K. M. Bohlander. Nov. 3, 1959. 24p. OTS.

Presented at American Society for Metals-Atomic Energy Commission Symposium on the Rare Earths and Related Metals, Chicago, Illinois.

Progress is reviewed on the fabrication techniques for rare earth metals including the processing into ingots, extrusion, forging, hot and cold rolling, swaging, and machining. (J.E.D.)

1812 AECU-4427
General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.
FORMING AND FABRICATION OF YTTRIUM METAL. J. M. Williams and C. L. Huffine. Nov. 5, 1959. 12p. OTS.

Presented at the Annual Meeting of the American Society for Metals, Chicago, Ill.

The fabrication and forming characteristics of yttrium metal are extremely sensitive to oxygen content. Metal having a purity of approximately 500 ppm of oxygen is relatively ductile and can be cold rolled 65 to 90% without edge cracking. Metal having oxygen contents between 1000 and 3000 ppm can be worked successfully at temperatures of 1650°F. The recrystallization temperature of yttrium is within the range of 1000 to 1200°F. Yttrium oxidizes rapidly above 1400°F, and for best results a protective atmosphere or enclosing can should be used for hot working operations. In handling the material where chips or fines are generated, extreme care should be taken to guard against fires by making the maximum size chip with sharp tools having a positive rake angle. Only lubricants having a high flash point should be used. Fines should be collected immediately and stored under a high flash point oil before burning to oxide. (auth)

1813 BMI-1338
Battelle Memorial Inst., Columbus, Ohio.
THE EFFECT OF IMPURITIES ON IRON–CHROMIUM–YTTRIUM ALLOYS. Roy W. Endebrock, Walston Chubb, Ellis L. Foster, and Ronald F. Dickerson. Apr. 27, 1959. 14p. Contract W-7405-eng-92. OTS.

A study was made of the effect of carbon, manganese, oxygen, palladium, and sulfur on the structure and fabricability of iron–35 wt. % chronium–1 wt. % yttrium alloy. Using a vacuum-induction melting technique each of the additives except oxygen was introduced to 1-lb remelts of a single 15-lb master alloy. The master alloy and remelts were made under similar melting, pouring, and casting conditions. Oxygen was introduced as Fe_2O_3 by inert-electrode arc melting to avoid extraneous, uncontrolled contamination stemming from crucible contact. Photomicrographs were prepared of as-cast metal illustrating structural variations. Ingots obtained were fabricated to 0.050-in. sheet at 2000°F to compare fabrication characteristics with those of the control ingot containing no additives. As a qualitative measure of metal soundness and ductility, a portion of each of the 0.050-in. sheets was further reduced at room temperature to 3-mil foil. During melting at 2900 to 3000°F under controlled conditions, the amount of yttrium present in the charge was reduced roughly 50% by reaction with the alumina crucible. Sulfide, added as FeS, and oxide additions also lowered the amount of yttrium retained in ingots. The maximum amount of sulfur retained in an alloy of nominal composition iron–35 wt. % chromium–1 wt. % yttrium–500 ppm sulfur was found to be about 80 ppm, and an alloy containing this amount of sulfur seemed to show slightly improved fabrication characteristics. None of the impurities investigated affected the fabrication characteristics or the quality of the finished product sufficiently to be considered detrimental from this point of view. (auth)

1814 CTR-324 through 331
Office of Technical Services, Washington, D. C.
WELDING. PARTS I THROUGH VIII, 1925-57. Catalog of Technical Reports. 47p. OTS.

These eight parts were issued separately, but are cataloged as a unit.

1815 KAPL-M-AME-19
Knolls Atomic Power Lab., Schenectady, N. Y.
FABRICATION OF THE TWO HOLE THIMBLE TEST ASSEMBLIES. E. F. Bulson, R. A. Epping, and E. C. Palmer. Aug. 31, 1959. 24p. Contract W-31-109-Eng-52. OTS.

Two prime 2-hole thimble test assemblies were successfully fabricated by welding and brazing techniques. These assemblies were of S3G Core 1 design for evaluation by SAR Engineering in autoclave tests to determine possible causes of failure. During the preparation, it was determined that multiple radial sectioning of the brazes used in these assemblies is feasible. Such sectioning provided greater assurance of disclosing discontinuities in the braze than the axial sectioning methods previously used. (auth)

1816 KAPL-M-AME-20
Knolls Atomic Power Lab., Schenectady, New York.
FABRICATION OF THE THREE-HOLE THIMBLE PROTOTYPE ASSEMBLY. R. A. Epping, D. R. Hauprich, E. C. Palmer, and T. B. Smith. Oct. 5, 1959. 18p. Contract W-31-109-Eng-52. OTS.

The 3-hole thimble prototype assembly was successfully fabricated by brazing techniques. This assembly is a prototype of the 3-hole thimble assemblies which are to be used on S3G Core 2 to accommodate additional instrumentation. The braze material flowed properly in all three holes despite their asymmetry with regard to the brazing coil. Evaluation of the multiple radial sectioning of the brazes used in these assemblies showed such sectioning to be a feasible though somewhat difficult method. (auth)

1817 KAPL-M-WAO-1
Knolls Atomic Power Lab., Schenectady, N. Y.
A STUDY OF INCONEL WELDING FOR NAVAL NUCLEAR POWER PLANT SERVICE. W. A. Owczarski and G. F. McKittrick. July 1959. 56p. OTS.

A study has been made of the weldability of Inconel with commercially available Inconel-type filler metals. The investigation included the welding and evaluation of structural welds, weld overlays, and the response of weld deposits to postweld thermal treatments. All the filler metals studied were found to be capable of producing welds meeting the current naval nuclear standards. However, all the welding processes and filler metals studied present problems or difficulties which limit their application. Several difficulties may be inherent to the filler metals and are recommended for further study. These difficulties are the fissuring tendency of all Inconel-type filler metals and the precipitation-hardening characteristics of the A wire weld deposit. The Inconel-type filler metals are more difficult to use than are the 300 series stainless steels. Vendors who attempt to use the Inconel-type filler metals as they do the 300 series stainless steels may fail to obtain nuclear quality weldments. (auth)

1818 LR-14059
Lockheed Aircraft Corp., Burbank, Calif.
HIGH ENERGY RATE METAL FORMING; INTERIM TECHNICAL ENGINEERING REPORT NO. 6, REPORTING PERIOD JULY 1 TO SEPTEMBER 30, 1959. A. F. Watts and Glen N. Rardin. 15p. ASC Project No. 7-588. Contract AF33(600)-35543.

Design parameters associated with the explosive forming process were investigated. An investigation is also being conducted to determine if the metallurgical properties of materials are affected in explosion forming. (W.L.H.)

1819 NAA-SR-3583
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
HOT-PRESSURE BONDING OF OMR FUEL PLATES. G. V. Alm, M. H. Binstock, and E. E. Garrett. Nov. 15, 1959. 62p. Contract AT-11-1-GEN-8. (OTS).

An aluminum-clad, low-enrichment, uranium-alloy fuel element of flat plate configuration has been proposed for the Organic Moderated Reactor (OMR). This fuel concept consists of an extended (finned) surface aluminum cladding metallurgically bonded to the alloyed uranium metal core by means of an intermediate nickel layer. Such a fuel system was examined to enable the following: (1) establishment of the method to obtain a satisfactory solid-state diffusion bond between the cladding and the core; (2) determination of optimum conditions required for bonding, once the method was established; and (3) fabrication of full-size OMR fuel plates for environmental and physical testing. Work accomplished to date includes investigation of hot-die pressing and inert-gas pressing (isostatic pressing). Isostatic pressing has been found to be the best method for solid-state bonding of the extended surface fuel design. Good bonding of nickel plated U–3.5 wt.% Mo alloys to aluminum claddings has been accomplished using helium and argon gas pressures of 4 to 5 tsi at 850 to 1000°F for 10 minutes. Full-size extended surface fuel plates assembled into prototype fuel elements for reactor irradiation tests were satisfactorily fabricated using the procedures outlined. (auth)

1820 NAA-SR-4030
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
CASTING DEVELOPMENT FOR URANIUM—MOLYBDENUM ALLOY SHAPES. M. H. Binstock and J. A. Stanley. Nov. 15, 1959. 28p. Contract AT(11-1)-GEN-8. OTS.

The casting of shapes of uranium—molybdenum metal of varying sizes and thicknesses from a molten charge has been successfully accomplished with specificially designed graphite distributors and molds. Solid cylinders, hollow cylinders, and flat plate shapes were cast in gang molds. As many as 35 solid cylinders have been cast simultaneously. All castings had smooth surfaces, and solid shapes were cast to 0.006-in. tolerance on all dimensions except length. (auth)

1821 NP-8035
Beryllium Corp., Reading, Penna.
BERYLLIUM CASTING. PHASE II. Interim Technical Engineering Report No. 4, Reporting Period: June 19, 1959 to September 18, 1959. Paul M. Cohen and R. C. Harris. 55p. ASC Project No. 7-643. Contract AF33(600)-37902.

The cause of the cracking that is visible immediately upon sectioning and that which occurs some time after the material is cast was determined. Metallographic work was performed on materials of varied chemistry and processing, and a relationship between both machining method and sample purity on the degree of cracking was noted. A scoping study was performed to evaluate the effect of pouring temperature on ingot structure. The final results of the contamination study indicate that all of the ceramics employed as crucible materials were suitable for melting beryllium when washed with a BeO—$BeSO_4$—water slurry. The tungsten analyses of the non-consumable arc melted ingots indicate considerable tungsten pickup, caused by alloying between the tungsten electrode and the feed stock that was attracted to it. (auth)

1822
TECHNOLOGY OF PRODUCING TUBES AND RODS OF MOLYBDENUM DISILICIDE. G. V. Samsonov and P. S. Kislyi. Ogneupory 24, 276-8(1959).

For the production of tubes and rods of $MoSi_2$ a mold is used in which the mass is pressed through a nozzle. The unworked tubes and rods were dried for 1 to 2 days at room temperature and then sintered in a hydrogen medium. In doing so, the unworked pieces were at first heated up to a temperature of 600 to 700°C, halting time 30 minutes, and then finished at a temperature of 1950°C, halting time 5 to 10 minutes. After that the products together with the furnace were cooled down to 900 to 1000°C. A deficiency is the high electrical conductivity of the heating elements made of molybdenum disilicide. Experiments introducing silicon-aluminum- and zirconium oxide in the layer were made to increase the electric resistance. Tubules of molybdenum disilicide can be used for the production of electrodes for semi-conductor thermocouples. (TCO)

1823
THE FATIGUE STRENGTH OF WELDED JOINTS IN Al—Mg ALLOYS MADE BY THE TIG PROCESS. R. Develay. Rev. mét. 56, 31-8(1959) June. (In French)

Results are given of fatigue tests on simple welded joints in alloys containing about 5 per cent magnesium subjected under certain conditions to forms of static and dynamic stressing which are not really efficient, but which may, however, occur in practice. The fatigue limit varies with the method of welding, the best procedure being butt welding. It further depends on the degree of static pre-stressing; in the case of butt welds, the pre-stressing should be such that the reverse side of the weld bead is in compression and the upper side in tension. In the case of butt welds, annealing after welding is controlled by the fatigue limit. Dressing the weld bead would readily have an beneficial effect. (auth)

1824
EFFECTS OF A LOW CONTENT OF ARSENIC ON MECHANICAL PROPERTIES OF SHEETS FOR HEAVY STAMPING. A. Kohn and J. Stremsdoerfer. Rev. mét. 56, 101-12 (1959) July. (In French)

The heavy-stamping capabilities of thin sheets of effervescing steel were studied to reveal information on the tendency of small As contents to affect properties sensitive to chemical heterogeneities. Two steels were compared, one containing 0.08% As and the other 0.02%. The two steels have a definite larger segregation, as shown by chemical analysis, which is of the same value in each. There is also a minor raised segregation which is manifested following simple attack at a polished surface of the sheet billets or sheets, as a fibrous effect. This latter segregation, also demonstrated by Dickenson's reagent, autoradiography, and Baumann imprints, corresponds to a general chemical heterogeneity. It is more pronounced in the steel richer in As. (T.R.H.)

1825
STRAIN-HARDENING EXPONENT OF CROSS-ROLLED BERYLLIUM SHEET. S. R. Maloof (Avco Corp., Wilmington, Mass.). Trans. Met. Soc. AIME 215, 872-3(1959) Oct.

The true stress vs. plastic strain for extruded and cross-rolled beryllium sheet is shown. (auth)

1826
USE OF A RADIOACTIVE ISOTOPE OF SULPHUR IN STUDYING SHAFT SMELTING OF OXIDIZED NICKEL ORES. N. F. Uspenskii and N. P. Diyev. Tsvetnye Met., No. 5, 63-7(1959).

In shaft smelting of oxidized nickel ores using gypsum sulfur, consumption is low and considerable nickel loss in waste slag occurs. A radioactive tracer method was used to study the influence of the form in which it is present on sulfur utilization. Smelting was effected in a laboratory shaft furnace. Crushed and screened nickel-ore sinter, limestone, and coke were smelted. Radioactive gypsum was prepared by precipitation from sodium-sulfate solution, itself prepared by calcining and oxidizing radioactive iron sulfide. The materials smelted were ordinary coke, high-sulfur coke, high-sulfur radioactive coke, ordinary gypsum, radioactive gypsum, and limestone, used in various combinations. The activities of the initial charge and of the gaseous and liquid smelting products were determined. This enables the degree of sulfur utilization from radioactive and nonradioactive materials to be calculated provided the amount of radioactive sulfur is small compared with that in the radioactive materials. The method is valid even when the chemical properties of the radioactive and ordinary isotopes are not identical. It was found that the radioactive sulfur transfers preferentially to the liquid products. Better utilization of sulfur when gypsum is replaced by calcium sulfide was confirmed. The method used in the work for preparing calcium sulfide by adding gypsum to the coking charge also improved utilization. (TCO)

Properties and Structure

1827 AD-118610

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

DEVELOPMENT OF COBALT-BASE ALLOYS. Progress Report No. 4 [for] September 26 – November 25, 1956. J. B. McAndrew and David W. Levinson. Dec. 5, 1956. 12p. Project No. B 102. Contract Noas-56-103-c.

Preliminary tests of oxidation resistance, room temperature and hot tensile strength, and hardness measurements for a number of binary alloys are reported. Twenty 250-gram button melts were prepared and fifteen tensile specimens were machined. Some remarkable high-tensile strengths were observed. (W.D.M.)

1828 AECU-4392

Illinois. Univ., Urbana.

DIFFUSIONLESS PHASE CHANGES IN NON-FERROUS METALS AND ALLOYS. Technical Progress Report [for] April 1, 1956 – February 28, 1957. T. A. Read, D. S. Lieberman, G. S. Baker, B. S. Subramanya, H. K. Birnbaum, and J. A. Mullendore. Mar. 15, 1957. 63p. Project No. 15. Contract AT(11-1)-67. (MEDUI-3-AEC). OTS.

Investigations are reported that are concerned primarily with the effects of quenching on transformations in the beta phase (β_1) of Cd–Au systems. Characteristics of Cd–Au single crystals composed of 47.5 and 49 at. % Cd were studied. In the 47.5% alloy, quenching from suitably high temperatures produced an entirely new phase (λ), similar to that of the low-temperature phase of the 49% alloy. No structural change of the low-temperature phase of the 49% alloy is suggested by the studies. Isothermal martensitic transformations were observed in both alloy crystals. Metallographic studies of the thermal reversible transformation occurring in slow cooled Au–Cd crystals containing 47.5 at. % Cd are reported. Electrolytic polishing methods are described, and data on transformation are presented graphically. Investigations of orthorhombic and tetragonal low-temperature phases continued. The dynamics of mechanical twinning were investigated by metallographic techniques, it was found that twins exhibit an anelastic behavior similar to that of transformation twins. The investigation of transformation twins was also continued. The anelastic behavior of the twin boundaries is a function of temperature and strain rate, and the effects of stress reversal indicates a crystal memory in twin formation. (J.R.D.)

1829 AECU-4393

Illinois Univ., Urbana.

DIFFUSIONLESS PHASE CHANGES IN NON-FERROUS METALS AND ALLOYS. Technical Progress Report [for] March 1, 1957 – March 31, 1958. T. A. Read, D. S. Lieberman, A. H. Ahmed, H. K. Birnbaum, W. Class, K. Mukherjee, and J. A. Mullendore. Apr. 1, 1958. 46p. Contract AT(11-1)-67 Project No. 15. (MEDUI-4-AEC). OTS.

The crystal structure lattice parameters, unit cell dimensions, habit plane, and twin plane were determined experimentally for the Au–Cd alloy 49 to 50 at. % Cd. The results are in agreement with the theory of W-L-R for martensitic transformation. Also, the crystal structure, lattice parameters, and unit cell dimensions of the λ phase were investigated. In a study of Au–Cd β' alloys single crystals of 47.5 at. % Cd – 52.5 at. % Au β phase were deformed in tension or compression and the slip traces on the polished surfaces examined. Data and observations are included. The behavior of transformation twin boundaries and mechanical twin boundaries under stress was examined and a theory of twinning behavior of the Au–Cd alloys is discussed. Comparative studies of 47.5 and 49 at. % Cd are discussed and it is pointed out that the results are similar. (For preceding period see AECU-4392.) (J.R.D.)

1830 AECU-4394

Illinois. Univ., Urbana.

DIFFUSIONLESS PHASE CHANGES IN NON-FERROUS METALS AND ALLOYS. Technical Progress Report [for] Period April 1, 1958 – April 30, 1959. T. A. Read, D. S. Lieberman, A. H. Ahmed, H. K. Birnbaum, W. Class, K. Mukherjee, and J. A. Mullendore. 198p. Contract AT(11-1)-67, Project No. 15. (MEDUI-5-AEC). OTS.

The motion of twin boundaries in the absence of plastic deformation and accomodation kinking were studied in β phase Au–Cd alloys. Crystals were grown from pure elements and prepared by grinding, and electrolytic polishing and etching. A proposed mechanism for twin boundary motion based on experimental results is presented. Aspects of this mechanism become apparent in the conclusions that nucleation of twinning dislocations under the applied stress requires thermal activation energy of <0.1 ev. Twin boundary motion occurs by nucleation of twinning dislocations adjacent to the existing twin interfaces and spreading of these loops by applied stress; new twin orientations also occur by this mechanism. The restoring force on the displaced boundaries results from increase in internal energy of the volume of the crystal through which the boundaries were displaced. Order faults in the crystals provide an effective barrier to the motion of the twinning dislocations through the lattice. Quenching effects in beta phase gold–zinc were investigated by studying the effects of quenching temperatures on the concentration of defects, and determination of the activation energy of formation. It was found that defects are thermally activated, and motions of the defects to sinks are also thermally activated. Relaxation around a vacancy is probably the cause of a discrepancy between results obtained from crystals resistivity measurements and volume change measurements. Results of a study to measure the kinetics of isothermal transformations and to compare isothermal and athermal transformations in annealed slow cooled 49 at. % Cd–Au alloys are reported. Mechanisms found in these transformations include isothermal growth of embryos with subsequent formation of martensitic plates, and movement of interfaces through large volumes of the crystal. (J.R.D.)

1831 AECU-4395

Rice Inst., Houston, Tex.

STRUCTURE AND SURFACE CHEMISTRY OF THORIUM OXIDE. Arthur L. Draper and W. O. Milligan. Sept. 1, 1959. 90p. [For Oak Ridge National Lab.] Contract W-7405-eng-26, Subcontract No. 1201. OTS.

The structure and surface properties of thorium dioxide were studied from the viewpoints of electron microscopy, electron diffraction, x-ray diffraction, and water vapor adsorption isotherms in an attempt to obtain a better understanding of the caking tendencies exhibited by some aqueous thoria slurries when circulated in loop experiments at elevated temperatures. In water vapor adsorption isotherms, there is observed chemisorption, as evidenced by relatively high heats of adsorption, slow rates of adsorption, and zero point drift. Kelvin pore size distributions computed from desorption isotherms exhibit a relatively sharp pore distribution at a radius of about 10 A, as well as a very broad spectrum of pores in the range of 10 to 200 A. Water surface areas are approximately the same as, or slightly larger than, nitrogen surface areas, suggesting that the predominant pores are able to accommodate both nitrogen and water molecules. X-ray- and electron-diffraction studies demonstrate that all samples are identical with standard thorium oxide, with no detectable amounts of polymorphs or crystalline impurities. Certain "extra" x-ray-diffraction lines observed have been traced to the use of x radiation not monochromatized by crystal reflection methods. X-ray line broadening decreases as the temperature of heat-treatment of the sample is increased. High-resolution electron micrographs show that the particles, ordinarily observed, actually consist of aggregates of minute crystals whose predominant morphology is that of octahedrons, with no indication of a plate-like structure. Electron micrographs show no definite correlation between caking and the morphology of the aggregates of crystallites. Thoria crystals heated to 1600°C exhibit rounded edges, suggesting the beginning of sintering. Such spheroidal particles should result in less erosion in circulation experiments. An electron micrograph of a sample of thoria, peptized by the addition of a small amount of palladium nitrate, exhibited excellent dispersion of individual crystallites. It is suggested that in future studies every effort be made to ensure complete dispersion of the samples, in the event high resolution and high magnification electron microscopy is contemplated. (auth)

1832 AECU-4398
Illinois. Univ., Urbana.
DIFFUSIONLESS PHASE CHANGES IN NON-FERROUS METALS AND ALLOYS. Progress Report for the Period October 15, 1954 to July 15, 1955. T. A. Read, D. S. Lieberman, H. Birnbaum, and H. Fara. July 1, 1955. 5p. Project No. 15. Contract AT(11-1)-67. (MEDUI-1-AEC). OTS.

Study of high purity Cd–Au alloy crystals is reported. In metallographic examination after low-temperature transformation orthorhombic phase (β'), it was found that the low-temperature structure is not a single crystal, but consists of an array of twin related regions. In thin crystal experiments a polishing method for samples of 5 micron thickness is being developed. Research is in progress on the mechanism of elastic twin boundary motion and the nature of relaxation processes associated with it. Construction of a relaxation measuring apparatus and a tensile test apparatus is complete. Observations and tests using these apparatuses are planned. (J.R.D.)

1833 AECU-4400
Denver. Univ. Denver Research Inst.
STUDY OF FACTORS INFLUENCING DUTILITY OF IRON–ALUMINUM ALLOYS. Monthly Report No. 6. Frank C. Perkins and Joseph F. Nachman. Oct. 9, 1959. 9p. Contract AT(11-1)-742. OTS.

Research on the effects of variations of aluminum content, heat treatment, and basic slip mechanism on the ductility of Al–Fe alloys is reported. Data from tensile tests on 13.9-Alfenol specimens are tabulated and test techniques are discussed along with the results. In addition, the preparation of a series of iron alloy buttons containing Al and various quantities of Mo is reported. Hot and warm rolling of these buttons is discussed. Data on resistivity of the iron alloy containing 13.9% Al and 3% Mo are presented graphically. (J.R.D.)

1834 AECU-4402
Denver. Univ. Denver Research Inst.
THE DETERMINATION OF THE EQUILIBRIUM PHASE DIAGRAM, ZIRCONIUM–NIOBIUM. Charles E. Lundin. Oct. 8, 1959. 8p. Contract AT(11-1)-752. OTS.

Research in the phase equilibria of Nb–Zr alloy systems as a function of composition and temperature is reported. A transformation study of iodide zirconium was conducted at 795 to 947°C. A series of Nb–Zr alloys were arc-melted and mounted for microscopic examination. Etchants for as-cast alloys were developed, and hardness data for as-cast alloys were gathered. Hardness data are presented graphically. (J.R.D.)

1835 BMI-1350
Battelle Memorial Inst., Columbus, Ohio.
AN EVALUATION OF THE PROPERTIES AND BEHAVIOR OF ZIRCONIUM–URANIUM ALLOYS. Arthur A. Bauer, ed. Sept. 28, 1959. 120p. Contract W-7405-eng-92. OTS.

Data from a survey of the literature and other available information on zirconium–uranium alloys have been reviewed for the purpose of obtaining a coherent picture of current knowledge about the properties and behavior of zirconium–uranium alloys. The results of the survey were used to revise and extend the presentation of material gathered earlier in a similar study and reported in BMI-1030 in August 1955. The constitution of zirconium–uranium alloys is discussed, and a constitutional diagram for the system is presented. The effects of oxygen and nitrogen, which are present in these alloys as contaminants, on alloy constitution are shown in the form of ternary diagrams and in terms of their quantitative effects on the phases present. The transformation kinetics and the nature of the transformation of the high-temperature body-centered-cubic gamma phase to the phases stable at room temperature are described. Two regions are discussed: in the 20 to 70 wt. % uranium composition range, gamma, which is retained on quenching, transforms isothermally to the intermediate epsilon-phase structure by a diffusion-controlled nucleation-and-growth process; in alloys containing less than 20 wt. % uranium, gamma transforms martensitically to a strained alpha-zirconium structure on quenching, with the diffusion-controlled transformation of gamma to either epsilon or alpha proceeding above the M_s temperature. Typical zirconium–uranium alloy microstructures produced by working and by various heat treatments are shown, and a correlation of the structure with the manner in which it was produced and the resultant mechanical properties is attempted. Hardness, tensile, and creep data for zirconium–uranium alloys are tabulated and evaluated in terms of alloy constitution and transformation-kinetics behavior. Physical-property data for zirconium–uranium alloys are presented in tabular and graphical form. The best fabrication techniques for forging, hot and cold rolling, extruding, and swaging are detailed. The corrosion resistance of zirconium–uranium alloys in water at various temperatures and corrosion behavior as affected by alloy constitution are discussed. The effect of ternary additions on corrosion resistance is discussed, and pertinent data are tabulated. The influence of zirconium–uranium alloy constitution and properties on neutron-irradiation behavior is discussed, and the general effects of irradiation upon these alloys are summarized. (auth)

1836 BMI-1383
Battelle Memorial Inst., Columbus, Ohio.
A STUDY OF THE EFFECTS OF FABRICATING CONDITIONS ON SOME PROPERTIES OF SINTERED URANIUM MONOCARBIDE. Arch B. Tripler, Jr., M. Jack Snyder, and Winston H. Duckworth. Oct. 2, 1959. 15p. Contract W-7405-Eng-92. OTS.

The effect of initial particle size (6.2 and 14.7 μ), forming pressure (50,000 and 100,000 psi), temperature (1600 and 1800°C), and time at temperature (1 and 3 hr) on the bulk density, grain size, and porosity of sintered uranium monocarbide compacts was studied. Within the limits of the variables studied, there appeared to be no significant changes in these properties of the sintered material attributable to the changes in the fabricating conditions. (auth)

1837 CAL-PI-1273-M-4
Cornell Aeronautical Lab., Inc., Buffalo.
AN INVESTIGATION OF THE THEORETICAL AND PRACTICAL ASPECTS OF THE THERMAL EXPANSION OF CERAMIC MATERIALS. VOLUME ONE—LITERATURE SURVEY. Summary Report for the Period July 1, 1958–August 31, 1959. Raymond H. Stutzman, John R. Salvaggi, and Henry P. Kirchner. Aug. 31, 1959. 162p. Contract NOrd-18419. (AD-220685).

A literature survey was conducted on the reversible thermal expansion of crystalline ceramics, rocks, and minerals, glasses, cermets, intermetallic compounds, salts, cements, glazes, and enamels and ceramics combined with other types of materials. Approximately 1200 references were collected of which 954 are assembled in a bibliography, 523 of the articles and reports were reviewed in detail and the results of thermal expansion measurements are published tabularly. (auth)

1838 CF-59-9-1
Oak Ridge National Lab., Tenn.
STUDY OF OXIDE FILMS AND SCALES ON ZIRCONIUM ALLOYS. Otto Zmeskal and G. M. Adamson. Sept. 1, 1959. 30p. OTS.

A study was made of the structure of the oxide films found on various zirconium alloys, primarily those with zirconium—niobium base compositions. With thick films, or scales, formed by oxidizing an alloy, it was possible to obtain directly a densely packed orthorhombic oxide, 6 $ZrO_2 \cdot Nb_2O_5$; the amount of which increased with increasing niobium content, oxidation temperature, and oxidation time. High temperatures were required for high percentages of the compound. With thin-film studies difficulties were encountered because of distorted structures in the oxides and growth on preferred planes of the base metal. The thin films were all predominantly monoclinic in nature, even those on alloys with appreciable niobium contents. (auth)

1839 DMIC-Memo-36
Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio.
HEAT CAPACITY OF BERYLLIUM. J. W. Holladay. Oct. 19, 1959. 10p.

The heat capacity of beryllium as a function of temperature and the effect of impurities on the heat capacity are discussed. (auth)

1840 IGR-TM/D-073
United Kingdom Atomic Energy Authority. Industrial Group. Dounreay, Caithness, Scotland.
ON THE COEFFICIENTS OF LINEAR THERMAL EXPANSION OF PURE NIOBIUM BETWEEN 60°K AND 1200°K. Feb. 1958. 5p.

1841 IS-1
Ames Lab., Ames, Iowa.
STUDIES ON THE PREPARATION, PROPERTIES AND ANALYSIS OF HIGH PURITY YTTRIUM OXIDE AND YTTRIUM METAL AT THE AMES LABORATORY. C. V. Banks, O. N. Carlson, A. H. Daane, V. A. Fassel, R. W. Fisher, E. H. Olson, J. E. Powell, and F. H. Spedding. July 1959. 250p. Contract W-7405-eng-82. OTS.

The research and development work carried out at the Ames Laboratory on the chemistry and metallurgy of yttrium is described in detail. Discussions of the separation of yttrium from the rare-earth elements by ion exchange, of comprehensive investigations of the preparation of yttrium fluoride, and of various ways of reducing the fluoride to the metallic state are presented. Chemical and spectrographic methods of analyzing yttrium and its compounds for oxygen and other impurities are described and comparisons made between the different methods. A pilot plant process for producing tonnage quantities of yttrium metal is presented with detailed descriptions of the equipment and operating procedures employed. The complete process entails the extraction of an yttrium and rare earth mixture from xenotime sand, separation of the yttrium from this mixture in thirty-inch-diameter columns, hydrofluorination of the resulting oxide, and its subsequent reduction to the metal. The basic metal process consists of the reduction of yttrium fluoride with calcium, forming a low melting yttrium—magnesium alloy. The magnesium is subsequently removed by vacuum sublimation, producing a porous yttrium product. This is consolidated by vacuum arc melting into a six-inch-diameter ingot. Quantities of high-purity yttrium metal were prepared by vacuum distillation and by a salt extraction refining process. Yttrium metal containing 100 to 300 ppm oxygen is soft, ductile, and easily fabricated at room temperature. (auth)

1842 NAA-SR-Memo-2529
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
MATERIAL PROPERTY DATA FOR UO_2. N. R. Koenig. Mar. 5, 1958. 7p. OTS.

The following properties of UO_2 were determined: thermal conductivity, density, specific heat, coefficient of linear expansion, melting point, modulus of elasticity, tensile strength, modulus of rupture, and Youngs modulus. (W.L.H.)

1843 NASA-TN-D-182
Stanford Univ., Calif.
INVESTIGATION OF IGNITION TEMPERATURES OF SOLID METALS. W. C. Reynolds. Oct. 1959. 71p. OTS.

The ignition temperature of a solid metal is related through a thermal definition of ignition to the rate of oxidation and to the radiation and convection heat-transfer parameters. The mechanisms of oxidation are reviewed, and the factors which influence ignition temperatures are discussed. Reasonable agreement between theoretical and experimental ignition temperatures is demonstrated. Experimental ignition temperatures for several metals are presented. (auth)

1844 NASA-TN-D-256
Illinois. Univ., Urbana.
FATIGUE DAMAGE DURING COMPLEX STRESS HISTORIES. H. W. Liu and H. T. Corten. Nov. 1959. 57p. OTS.

The relation between fatigue life and the relative number and amplitude of imposed cycles of stress was determined in wire specimens of 2024-T4 and 7075-T6 aluminum alloys and hard drawn steel. Agreement was excellent between the hypothesis that the fatigue life was adequately described by a two-parameter expression involving the percent of cycles at high stress and a stress interaction factor and the experimentally determined fatigue life. (auth)

1845 NP-7989
Battelle Memorial Inst., Columbus, Ohio.
AN INVESTIGATION OF THE EFFECTS OF SOLUTE ELEMENTS ON MAGNETOELASTIC DAMPING AND COERCIVITY IN VERY PURE IRON. Summary Report. R. E.

Maringer and G. K. Manning. Oct. 1, 1959. 23p. Contract Nonr-2606(00).

Data are presented showing the time and temperature dependence of the damping in zone-melted iron containing small amounts of carbon. The differences in the damping of magnetized and unmagnetized specimens are assumed to represent the magnetoelastic contribution to the damping. The magnetoelastic contribution increases with increasing temperature in the vicinity of the Snoek peak, shifting the temperature and distorting the shape of this peak. At lower temperatures, the damping decreases with time after the removal of an a-c field. The kinetics of this damping decrease are similar to those of the time-dependent decrease in permeability after demagnetization. Relaxation times calculated for this "magnetoelastic aftereffect" are in excellent agreement with those associated with the interstitial diffusion of carbon in alpha iron. Measurements of the temperature dependence of the induced voltage in a transformer type apparatus have revealed a sigmoidal increase in the induced voltage with increasing temperature. This increase is apparently related to the temperature-dependent increase in magnetoelastic damping, and calculated relaxation times indicate that the interstitial diffusion of carbon is responsible. (auth)

1846 NP-8005

North Carolina State Coll., Raleigh.

ELECTRICAL CONDUCTIVITY AND DIELECTRIC PROPERTIES OF CERAMIC MATERIALS WITH THE PEROVSKITE STRUCTURE, AND A SOLID STATE REACTION STUDY IN THE PEROVSKITE SYSTEM, BARIUM STRONTIUM TITANATE AND BARIUM STRONTIUM ZIRCONATE. Mar. 31, 1958. 117p. Contract Nonr-486-(02).

A summary of research on electric conductivity and dielectric properties of ceramic materials with the Perovskite structure is presented. Information gained in a solid state reaction study of barium titanate is included. It was found that 1365°C is a critical point in controlled titanate crystal growth. Other observations based on the data are that purity has a pronounced effect on electric properties and crystal development, and that rapid sintering rates enhance the development of small and uniform matrices when temperatures below 1365°C are used. (J.R.D.)

1847 NYO-4686

Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy.

THE THERMODYNAMIC PROPERTIES OF THE ALUMINUM–SILVER SYSTEM (thesis). Thomas C. Wilder and John F. Elliott. 1959. 51p. Contract AT(30-1)-1888. OTS.

An electrode potential study of the liquid aluminum–silver system has been conducted with the cell Al(l) | Al^{3+} (in KCl + NaCl) | Al in Ag(l) in the temperature range 700 to 980°C. The activities of both components F_i^M, F_i^E, F^E, and TS^E were determined for 700 and 900°C, and H_i^M and H^M for the temperature range of 700 to 980°C. The activity curves are found to be similar in shape to those estimated by Chou and Elliott, but they are more ideal in the vicinity of pure Al. Activity curves for Al and Ag at 820°K (647°C) in the solid phases have been computed and compared with those previously reported by Hillert and co-workers. Values for $\log \gamma_{Al}$ in the liquid systems Al–Fe, Al–Fe–C, and Al–Fe–Si–C at 1600°C have been redetermined using the distribution data of Chipman and Floridis, and Chipman and Langenberg. (auth)

1848 WADC-TR-57-374(Pt.III)

National Bureau of Standards, Washington, D. C.

PHYSICAL PROPERTIES OF HIGH TEMPERATURE MATERIALS. PART III. THE THERMAL AND ELECTRICAL CONDUCTIVITIES OF SEVERAL ZIRCONIUM HYDRIDES UP TO 800°C. [Period covered]: March 1956 to July 1957. Howard W. Flieger, Jr. and Defoe C. Ginnings. Aug. 14, 1957. 43p. Project title: MATERIALS ANALYSIS AND EVALUATION TECHNIQUES. Task title: THERMAL MEASUREMENTS. USAF Delivery Order No. AF(33-616)56-21.

The thermal conductivity of zirconium hydride was investigated at temperatures 100 to 800°C and with varying hydrogen content. Specimens with four different hydrogen contents were used, corresponding to $N_H = 2.16$ to 4.13 for three "unclad" specimens and to $N_H = 4.41$ for one "clad" specimen. The measurements were made with an apparatus employing steady-state longitudinal heat flow in a rod of zirconium hydride surrounded by a "guard" tube with matching temperature gradient to minimize radial heat loss. In addition to the thermal conductivity measurements, electrical conductivity measurements of some of the specimens were made. (auth)

1849 WADC-TR-58-539

Minnesota. Univ., Minneapolis.

GRAIN SIZE EFFECTS ON FATIGUE AND THEIR RELATIONSHIP TO NOTCH GEOMETRY, STRESS GRADIENT AND SIZE OF SPECIMENS. Period covered: January 1957 to July 1958. F. H. Vitovec. Sept. 11, 1958. 38p. Project title: MATERIALS ANALYSIS AND EVALUATION TECHNIQUES. Task title: FATIGUE AND CREEP OF MATERIALS. Contract AF33(616)-5449. (AD-206665; PB-151598). OTS.

A study was conducted on the effect of grain size, size of specimen and stress gradient on the direct stress fatigue strength of a 2.5 Al-magnesium alloy at room temperature. Specimens with three different grain sizes and seven different notch sizes were used in this investigation. The data are analyzed with regard to relationships between grain size, size of notch, relative stress gradient, stress gradient per grain, and theoretical strength of notched specimens. (auth)

1850 WAL-TR-397-1/2

Watertown Arsenal Lab., Mass.

THE SPECTRAL EMISSIVITY AND TOTAL NORMAL EMISSIVITY OF GRAPHITE AT ELEVATED TEMPERATURES. Albert F. Grenis and Albert P. Levitt. Nov. 1959. 17p. DA Project 5B93-32-004. OTS.

An improved high-temperature apparatus and technique were developed for measuring the spectral and total normal emissivity of electrically conducting refractory materials. The total normal emissivities and spectral emissivities, at an effective wavelength of 0.65 microns, were determined for machined surfaces of the graphites National Carbon AGX and Speer 580. The total normal emissivities were investigated within the range of 1600 to 3000°C. The spectral emissivities were investigated within the range of 1000 to 3000°C. (auth)

1851 AEC-tr-3872

INVESTIGATIONS IN THE TANTALUM–OXYGEN SYSTEM. 1. CONCERNING THE MECHANISM OF OXYGEN UPTAKE AT HIGH TEMPERATURES. Erich Gebhardt and Hans-Dieter Seghezzi. Translated by Richard M. Bidwell (Los Alamos Scientific Lab.) from Z. Metallk. 50, 248-57 (1959). 28p. JCL.

Tantalum was gassed with pure oxygen at 700 to 1420°C and at 1×10^{-3} and at 2×10^{-2} millimeters. Under these conditions three simultaneous reactions could be observed: the formation of a Ta_2O_5 crust growing parallel to the sample surface; the formation of laminated oxide growing into the tantalum sample; and the solution of oxygen in tantalum with formation of tantalum–oxygen solid solution (alpha phase). The interplay of the three reactions is influenced by both temperature and pressure but in opposite directions. Separate investigations of the three reactions mentioned and their reaction products showed that the laminated oxide is a hitherto unobserved suboxide of unknown structure and composition. The oxide laminae lie exclusively on cubic planes of the solid solution and accordingly change their directions at the grain boundaries of the alpha crystallites. The oxide lattice is oriented to the alpha matrix so that a definite lattice direction of the oxide is perpendicular to the growth interfaces of oxide and solid solution. This lattice direction is characterized by its characteristic optical behavior in linearly polarized light. Investigations on the outer film of Ta_2O_5 showed that this oxide contains oxygen vacancies which are easily mobile at the temperature studied. The layers formed are adherent, very hard, compact and free of cracks, and attached firmly to the substrate. In contrast to this, gassings in air undertaken for comparison at 600 to 900° led to Ta_2O_5 layers which were porous and easy to remove. Solution formation was followed especially as a function of location and time, at 900°C and 2×10^{-2} millimeters, by microhardness measurements. Thus it was found that the transfer of oxygen atoms at the edge of the tantalum occurs very rapidly. Diffusion in the tantalum interior on the other hand occurs significantly slower. The amount of oxygen taken up, which is used in the three reactions mentioned, increases linearly with time at 2×10^{-2} millimeters and 700 to 1000°C. Above 1000°C, on the other hand, the oxygen uptake shows a more complicated time dependence. A discussion of the atomic processes participating shows that between 700 and 1000°C the kinetics of the three simultaneous reactions are coupled and are controlled by this rate of transfer of oxygen atoms or ions from a chemisorbed layer into the Ta_2O_5 crust. Above 1000°C the coupling ceases and the individual reactions whose rates are determined by different atomic processes independent of each other are now superimposed. (auth)

1852 TT-833

THE EFFECT OF FIBRE ORIENTATION ON THE FATIGUE STRENGTH OF HARDENED STEEL. (Vliyanie Orientirovki Volokon Na Kontaktnuiu Ustalostnuiu Prochnost' Zakalennoi Stali). A. S. Shein. Translated by R. Remorenko (National Research Council of Canada) from Metalloved. i Obrabotka Metal., No. 12, 61-6(1957). 15p. NRC or JCL.

Examination of the macrostructure of the surface of test specimens made it possible to recognize three orientations of metal fibers: lengthwise, transverse, and end-grain. For transverse orientation of fibers, the limiting strength of hardened steel is 20% greater, and the contact endurance is 3 to 5 times greater than for end-fiber orientation. A study of the effect of macrostructure upon the contact strength of hardened steel enabled technical applications significantly increasing the endurance of bearings. (auth)

1853

AN X-RAY INVESTIGATION OF THE NICKEL–BORON SYSTEM. THE CRYSTAL STRUCTURES OF ORTHORHOMBIC AND MONOCLINIC Ni_4B_3. Stig Rundqvist (Univ. of Uppsala). Acta Chem. Scand. 13, 1193-1208 (1959).

The Ni-B system was investigated with x-ray powder and single-crystal methods in the range Ni_3B to NiB. In addition to the previously known intermediate phases, Ni_3B, Ni_2B, and NiB, the existence of two other phases, both with the ideal compositions Ni_4B_3 but one orthorhombic and the other monoclinic, was established. The following two-phase regions were found: $Ni_3B + Ni_2B$, Ni_2B + orthorhombic Ni_4B_2, orthorhombic Ni_4B_3 + monoclinic Ni_4B_3, and monoclinic Ni_4B_3 + NiB. The unit cell of orthorhombic Ni_4B_3 varies slightly with composition. The dimensions in two-phase Ni_2B + orthorhombic Ni_4B_3 alloys are the following: $\alpha = 11.953$ A, $b = 2.981$ A, and $c = 6.569$ A and in two-phase orthorhombic Ni_4B_3 + monoclinic Ni_4B_3 alloys: $a = 11.973$ A, $b = 2.985$ A, and $c = 6.584$ A. The unit cell dimensions of monoclinic Ni_4B_3 are $a = 6.430$ A, $b = 4.882$ A, $c = 7.818$ A, and $\beta = 103°18'$. No unit cell variation of the latter phase was found. The crystal structures of the two new phases were determined and refined from single-crystal intensity data. The space group of orthorhombic Ni_4B_3 is P n m a. The unit cell contains sixteen nickel atoms and twelve boron atoms situated in 4(c) positions. Two-thirds of the boron atoms form infinite zig-zag chains, while one-third have no close boron contacts. There are probably boron vacancies in the structure. The space group of monoclinic Ni_4B_3 is C 2/c. Sixteen nickel atoms are situated in two 8 (f) positions, eight boron atoms in one 8 (f) position, and four boron atoms in one 4(e) position. All boron atoms are connected in infinite chains. (auth)

1854

LATTICE DEFECTS IN A COPPER–ALUMINUM ALLOY. M. S. Wechsler and R. H. Kernohan (Oak Ridge National Lab., Tenn.). Acta Met. 7, 599-607(1959) Sept.

Static (at-temperature) resistivity measurements and measurements after air-cooling and water-quenching indicate an excess resistivity contribution at temperatures above 200°C in Cu–Al (15 at. % Al) single crystals. From the static measurements, the energy of formation of the configuration responsible for the excess resistivity is determined to be about 0.2 ev. Annealing experiments after quenching from 450°C were conducted, from which the activation energy for motion was evaluated. These experiments are correlated with a previous investigation of the effect of neutron irradiation on Cu–Al alloys, and a discussion is given in terms of short-range ordering and the annealing of lattice vacancies. (auth)

1855

TWINNING IN TANTALUM. R. W. Anderson and S. E. Bronisz (Los Alamos Scientific Lab., N. Mex.). Acta Met. 7, 645-6(1959) Sept.

Twinning of high purity tantalum after impact deformation by hammering at room temperature is reported. It was found that increasing the purity of tantalum increases the ease with which twins may be formed. (C.J.G.)

1856

THE PHASE DIAGRAM OF THE Zr - Re SYSTEM. E. M. Savitskiĭ, M. A. Tylkina, I. A. Tsyganova. Atomnaya Energ. 7, 231-5(1959) Sept. (In Russian)

The Zr - Re phase diagram was studied by x-ray diffraction and microscopic methods and by determining the melting point, hardness, and microhardness. Solid solutions of Re in α zirconium at 800° contain about 0.5 wt. % Re, increasing to 2 to 3 wt.% at the eutectoid transformation temperature. At 1600°C 14.68 wt.% Re is dissolved in β - Zr, increasing to 8 wt.% Re at 550 to 600°C the eutectoid transformation point. The β phase becomes stable in alloys containing more than 4 wt.% Re. The eutectic composition is reached at 1600°C and 25 wt.% Re. The presence of metastable ω phase is found in zirconium reach alloys. The solubility of zirconium in rhenium is less than 2 wt.% at 2500°C. Three chemical compositions are formed by peritectic reactions: at 2500°C Zr_5Re_{24} with a face-center cubic lattice (α = 9.6 to 9.7 kX) and microhardness of about 1000 kg/mm^2; at 2450°C $ZrRe_2$ with a close-packed hexogonal lattice (a = 5.21 to 5.25A; C = 8.5 to 8.56 and, C/a = 1.63) and microhardness of 1200 kg/mm^2; at 1900°C Zr_2Re with a σ phase tetragonal lattice (a = 10.12 A; C = 5.42 A; c/a = 0.535) and microhardness of 700 to 800 kg/mm^2. (R.V.J.)

1857

EFFECT OF ANISOTROPY OF DILATATION COEFFICIENTS ON THE ELASTIC PROPERTIES OF URANIUM, ZIRCONIUM, AND ZINC. Daniel Calais, Georges Saada, and Nicole Simenel (Ecole des Mines, Paris). Compt. rend. 249, 1225-7(1959) Oct. 5. (In French)

The anisotropy of the dilation coefficients of U, Zr, and Zn causes internal tensions during cooling of these metals. Restoration at room temperature eliminates the effect for Zn but for U and Zr the tensions persist. This is responsible for the lack of an elastic limit in these two metals. (tr-auth)

1858

ON THE CONDUCTIVITY OF DISPERSE MIXTURES WITH IMPERFECT CONTACTS BETWEEN THE PARTICLES. V. V. Skorokhod and I. M. Fedorchenko (Inst. of Metals and Alloys, Academy of Sciences, Ukrainian SSR). Dopovidi Akad. Nauk Ukr. R.S.R. No. 7, 756-9(1959). (In Ukrainian)

A method for calculating the conductivity of disperse statistical mixtures with imperfect contacts between the particles is proposed. The method is based on the theory of electrical contacts and an analogy existing between contact resistance and poor conductive film resistance. The method is applicable to mixtures of any concentration and any number of phases. The conductivity of pressed one-component bodies was calculated by this method, applying experimental data on porosity and pressure of pressing. The results of experimental measurements of conductivity show satisfactory agreement with the calculated ones. (auth)

1859

DIELECTRIC BREAKDOWN OF POROUS CERAMICS. Robert Gerson and Thomas C. Marshall (Clevite Corp., Cleveland). J. Appl. Phys. 30, 1650-3(1959) Nov.

A statistical approach is used to determine the effect of porosity in ceramic materials on their dielectric breakdown strength. The calculated drop in dielectric strength is in good agreement with the experimental data for lead zirconate titanate ceramics. The theory shows that the measured dielectric strength in porous materials is a function of the porosity, the void size, and of the dimensions of the test sample. (auth)

1860

DOMAIN PROCESSES IN LEAD TITANATE ZIRCONATE AND BARIUM TITANATE CERAMICS. Don Berlincourt and Helmut H. A. Krueger (Clevite Corp., Cleveland). J. Appl. Phys. 30, 1804-10(1959) Nov.

The amount of 90° reorientation during poling was determined from mechanical strains measured during the poling process. With tetragonal lead titanate zirconate 53% of the possible 90° reorientation occurred during poling, but this figure dropped to 44% upon removal of the poling field. With barium titanate the figures are only 17 and 12%, respectively. Comparison of the polarization of poled polycrystalline barium titanate with that for single crystals indicates that 180° reorientation is virtually perfect. Application of very high compressive stress parallel to the polar axis causes 90° switching of nearly all aligned domains, and, therefore, removes virtually all polarization. Curves of released charge as function of mechanical strain are nearly linear, but curves of released charge as function of stress are strongly nonlinear. Application of high compressive stress perpendicular to the polar axis also causes 90° domain reorientation and a reduction in the total polarization of the ceramic. This domain reorientation may be interpreted as a shift of the polar axes of some domains into a position more closely corresponding to the plane of cross expansion, and typically the total electric moment is reduced by less than 10%. High electric stress causes 180° as well as 90° domain reorientation. With prepoled specimens dc fields in the same direction as the poling field cause 90° switching, while reverse dc fields cause both 90 and 180° reorientation, with the latter predominating. (auth)

1861

THE CRYSTAL STRUCTURE OF THE COMPOUNDS OF URANIUM WITH GERMANIUM. Ye. S. Makarov and V. N. Vykov. Kristallografiya 4, No. 2, 183-5(1959).

Laue, oscillation, and powder photographs showed that U_5Ge_3 is hexagonal with a= 8.56 and c = 5.78 kX. d_{obs} = 13.4 g/cm^3 gives 16.8 atoms per cell representing Z = 2. By analogy the compound was assumed to have a structure of the Mn_5Si_3 (Mn_5Ge_3) type. An electron density projection onto 0001 was calculated. This showed that the structure is actually of the Mn_5Si_3 type. The space group is D_{6h}^3 = C6/mcm with $4U_I$ in 4(d) positions; $6U_{II}$ in 6(g) positions with x_U = 0.24 and 6Ge in 6(g) positions with x_{Ge} = 0.62. Good agreement between observed and calculated structure factors is obtained. Laue and oscillation photographs of single crystals of U_3Ge_4 showed the material to be orthorhombic with a = 5.86, b = 9.86, c = 8.96 kX. UGe_2 was similarly shown to be orthorhombic with a = 4.11, b = 15.1, c = 3.97 kX. Z = 12 and the dimensions of the unit cell are similar to those of $ZrSi_2$ and $ZrGe_2$. Comparisons of observed S.F.s and those calculated using $ZrSi_2$ coordinates gave a reliability factor of 0.25. The $ZrSi_2$ structure with space group D_{2h}^{17} = Cmcm is therefore likely. It was confirmed that UGe_3 has the $AuCu_3$ structure with a = 4.197 kX. (TCO)

1862

DISLOCATION ARRANGEMENTS IN ALUMINUM DEFORMED IN TENSION OR BY FATIGUE. R. L. Segall and P. G. Partridge (Cavendish Lab., Cambridge, Eng.). Phil. Mag. (8) 4, 912-19(1959) Aug.

A comparison was made of transmission electron microscope observations on polycrystalline aluminum deformed in tension or by fatigue. The dislocation distribution in aluminum deformed in tension was studied as a function of stress. At stresses up to 3 kg mm^{-2} the distribution is extremely irregular; at higher stresses up to the fracture stress, polygon boundaries are formed which become increasingly well developed with increasing stress. Observations were made on specimens fatigued at high stress, giving a life of 10^5 cycles, and low stress, giving a life greater than 10^6 cycles. The dislocation distribution in the former is similar to that in the unidirectionally deformed specimens. The low stress fatigue specimens show two new features. Firstly, polygonization does not occur despite a high dislocation density, and secondly, a high density of dislocation loops similar to that found in quenched specimens is observed in some areas. The latter observation suggests the formation of large numbers of point defects during fatigue. (auth)

1863

HAFNIUM CARBIDE AND ITS BEHAVIOR WITH RESPECT TO OTHER CARBIDES OF THE HIGH-MELTING TRAN-

SITION METALS. H. Nowotny, F. Benesovsky, and R. Kieffer (Chemisches Institut der Universität, Vienna and Metallwerk Plansee AG., Reutte/Tirol, Austria). Powder Met. Bull. 7, 79-87(1959) Aug. (In German)

The binary systems of HfC with the carbides of the high melting metals of the 4a and 5a group having the B1-structure and with the structurally different carbides of the 6a group were examined by means of homogenized hotpressed specimens. HfC shows full miscibility with TiC, ZrC, NbC, and TaC. The mutual solubility of HfC and VC is small as would be expected from the difference in lattice parameters. Possessing a different structure, Cr_3C_2 is insoluble in HfC; a pseudocubic MoC can be dissolved in HfC up to 90 mol %. The solubility of WC in HfC at 2000°C. amounts to about 40 mol % WC. The schematic presentation of solubilities in the binary systems of B1-carbides of the 4a and 5a elements can be completed with the data of the present investigation. With respect to the systems UC–HfC and ThC–HfC, one finds a perfect substantiation of the 15%-rule.

1864

TRANSIENT TEMPERATURES IN A URANIUM ROD. C. S. Lowthian (AEI-John Thompson Nuclear Energy Co., Ltd., Knutsford, Ches., Eng.). Reactor Sci. 10, 95-103(1959) Sept.

The equation for the temperature distribution in a uranium rod under transient conditions is subjected to the finite Hankel transform, to produce a formal relationship between the physical parameters of rate of heat production, rate of heat removal and the temperature at any point in the rod. The form of solution is applied to find the changes in uranium surface and center temperatures following arbitrary changes in the rates of heat production and heat removal. The method is an inverse one in that arbitrary forms are assumed for a function $\phi(t)$ which is introduced into the equations, and the resulting variations of uranium temperature and rates of heat production and removal are examined. Within this limitation, however, the temperature and reactivity changes within the reactor can be determined for a short period of time following a disturbance, during which the relatively small thermal capacity of the uranium makes it the dominating variable. (auth)

1865

THE TRANSFORMATION TEMPERATURE OF HAFNIUM. D. K. Deardorff and Haruo Kato (U. S. Bureau of Mines, Albany, Ore.). Trans. Met. Soc. AIME 215, 876-7(1959) Oct.

In contrast to previously published values believed to be inaccurate, the transformation temperature of hafnium was found to be 1750°C. (J.E.D.)

1866

USE OF RADIOACTIVE INDICATORS IN STUDYING THE DISTRIBUTION AND BEHAVIOUR OF ADMIXTURES IN THE PRODUCTION OF ALLOYS. T. A. Potapova and S. T. Prokhorov. Tsvetnye Met., No. 5, 70-80(1959).

The radioactive isotopes Cr^{51}, Cu^{64}, Zn^{65}, Zr^{95}, and W^{185} were used in the study of Al alloys. Two methods of radiation detection were used–ionization for control, and radiographic to investigate the distribution of the elements in the alloys. All the alloying elements except Cr were added as master alloys. Cr alloys were made by adding a mixture of equal parts of Cr oxide and cryolite to Al at 1000°C. The intensity of radiation from 200 g samples was 25 m curie for Cu^{64} and 5 m curie for the remainder. The radiographic method measured β-radiation for all the alloys except those containing Zn^{65} although all the elements except Cr^{51} emit both β and γ radiation. The distribution of Zn in Al–Zn alloys was investigated in the cast state and after tempering at 435°C for 24 hr. It was uniform in both cases. Similar results were obtained for the distribution of Cr in Al–Zn–Mg–Cu alloys. Two alloys of the Al–Zn–Mg–Cu type containing approximatel 2 and 0.2% Cu were examined for Cu distribution in the cast state, after homogenizing at 430°C for 17 hr, after hot rolling at 460°C, after quenching from 470°C, after heating at 430°C and slow cooling in the furnace, and after quenching and ageing at 120°C for 9 hr. On all the radiographs there was a uniform background with individual light spots. The Cu was shown to be in solid solution and not in the grain boundaries by magnifying to 100X. The light spots on the macro radiograph indicate local concentrations of Cu, the quantity and intensity being proportional to the Cu content, and decreasing after thermal and mechanical treatments. It was proposed that they were centers of corrosion in alloys containing more than 1% Cu. Alloys were therefore tested for two weeks in 3% aqueous solution of NaCl and 0.1% H_2O_2. Photographs of the surfaces were taken and compared with the radiographs. This confirmed that the local concentrations of Cu were indeed the centers of corrosion. (TCO)

1867

CARBON NITRIDE OF TANTALUM. Georg Brauer and Richard Lesser (Universität, Freiburg/B.). Z. Metallk. 50, 512-15(1959) Sept.

The ternary system tantalum–TaC–TaN was investigated by chemical and x-ray methods between 1250 and 1450°. The phases α, β_1, β_2, δ, ζ, and η were observed and their structures—except that of ζ—determined. The phase diagram for the above temperature range is given. (auth)

1868

OBSERVATIONS ON THE SURFACE STRUCTURE OF TITANIUM CRYSTALS CRYSTALLIZED FROM THE MELT. Franz Bollenrath (Rhein.-Westf. Techn. Hochschule, Aachen). Z. Metallk. 50, 515-20(1959) Sept. (In German).

From the surface structure of titanium crystals grown out of the melt structural relations between the α and the β phase can be visualized. An interpretation is given for the relief which appears on the surface of a polished specimen after an $\alpha/\beta/\alpha$ transition. Furthermore from observations of the surface, conclusions can be drawn about the mechanisms of plastic deformation. (auth)

1869

INVESTIGATIONS IN THE TANTALUM–OXYGEN SYSTEM. II. REACTIONS AND EQUILIBRIA BETWEEN MIXED CRYSTALS AND OXIDE PHASES. Erich Gebhardt and Hans-Dieter Seghezzi (Max-Planck-Institut für Metallforschung, Stuttgart). Z. Metallk. 50, 521-7(1959) Sept. (In German).

Reactions and equilibrium states between mixed crystals of tantalum–oxygen, a laminated suboxide, and Ta_2O_5 were investigated in high vacuum between 500 and 900°. The maximum solubility of oxygen in tantalum between 500 and 1500° was determined. (auth)

1870

CREEP OF CUBIC FACE-CENTERED METAL SINGLE CRYSTALS. Michael Michelitsch (Technische Hochschule, Stuttgart and Max-Planck-Institut für Metallforschung, Stuttgart). Z. Metallk. 50, 548-60(1959) Sept.

Creep behavior of single crystals of copper, aluminum, nickel, and nickel-cobalt was studied. Logarithmic creep is found in stage I of the stress-strain curve, hyperbolic ($m \approx 1,1$) in stage II, and parabolic ($m < 1$) in stage III.

The work-hardening coefficient ϑ has a maximum in the transient stage I–II, in stage II it goes down by about 25% to a constant level. In stage I, activation volume found from logarithmical creep rate-time curves does not agree with that found from temperature change tests. This discrepancy can be explained by using a spectrum of activation energies and activation volumes, respectively. (auth)

1871

WETTING OF BORIDES AND CARBIDES BY LIQUID METALS. V. N. Eremenko and Yu. V. Naidich. Zhur. Neorg. Khim. 4, 2052-7(1959) Sept. (In Russian)

Wetting of borides by copper at 100 to 1500°C in argon showed the following wetting temperatures: $TiB_2 > 1500°$; $NbB_2 \sim 1450$; $VB_2 \sim 1300$ to 1350; $ZrBr_2 \sim 1100$ to 1150; and $TaB_2 < 1100$. Wetting of TiB_2 by Ni at 1480°C in helium atmosphere did not exhibit any appreciable interaction disintegration of phases. The NbB_2–Ni system does not melt even at 1550°C and the boride surface corrodes under nickel. Wetting of TaB_2 by Ni at 1480°C in helium forms a new friable phase while in CrB_2 and MoB_2 the surface of the metal becomes rough with sharp ridges. Wetting of borides is correlated with the properties of borides and their atomic bond. It is also shown that only transition metals are capable of wetting carbides. (R.V.J.)

1872

POLYMORPHOUS TRANSFORMATIONS OF CHROMIUM ALLOYED WITH TANTALUM. A. T. Grigor'ev, L. N. Guseva, E. M. Sokolovskaya, and M. V. Maksimova (Lomonosov Moscow State Univ.). Zhur. Neorg. Khim. 4, 2168-9(1959) Sept. (In Russian)

Microscopic, thermal, and x-ray analyses were used in studies of chromium–tantalum alloys (rich in chromium) annealed at high temperatures. The position of the solidus line and the maximum tantalum solubility in chromium at eutectic temperature were checked. It was found that chromium changes from one modification into another ($\Sigma \rightleftharpoons \delta$) at 1830°C. It was also shown that immediately following cooling the chromium has a body-centered cubic lattice which agrees with the formation of continuous series of solid solutions of chromium with σ modification. (R.V.J.)

1873

Ni–Al ALLOY WITH LOW LINEAR COEFFICIENT OF EXPANSION. I. I. Kornilov and R. S. Mints. Zhur. Neorg. Khim. 4, 2169-71(1959) Sept. (In Russian)

The constitution diagram of Ni–Al alloys (31.5% Al) contains two chemical compounds, NiAl and Ni_3Al, and three solid solution zones. The NiAl compound melts at 1640°C and Ni_3Al at 1395°C. It is shown that compounds of the NiAl type possess minimum linear coefficient of expansion. (R.V.J.)

1874

PRIMENENIYE RADIOAKTIVNYKH IZOTOPOV V METALLURGII I METALLOFIZIKE. (Use of Radioactive Isotopes in Metallurgy and Physical Metallurgy). Ivan Stepanovich Kulikov. Moscow, Gosudarstvennyy nauchno-tekhnicheskii komitet and Akademiya nauk SSSR, 1958. 46p.

The book deals with the use of radioactive isotopes in industrial metallurgical processes and investigations of the mechanisms of alloy formation, diffusion in solids, sublimation, and other phenomena. TCO

Radiation Effects

1875 58-RL-2125

General Electric Co. Research Lab., Schenectady, N. Y.

EFFECTS OF RADIATION-GENERATED HELIUM AND TRITIUM ON THE PROPERTIES OF ALUMINUM–LITHIUM ALLOYS. D. W. Lillie. Sept. 26, 1958. 18p.

Property changes produced by irradiation of Al–0.4 wt. % Li alloys at 270°C to a burnup of 0.155% of all atoms are described. Metallographic evidence of the formation of internal pores and the concentration of gases at grain boundaries is shown. Some conclusions are drawn concerning desirable property characteristics for resistance to radiation swelling. (auth)

1876 BSR-6

Bendix Aviation Corp. Bendix Systems Div., Ann Arbor, Mich.

NUCLEAR TEST OF SCINTILLA CONNECTORS. Sept. 1, 1958. 54p. Contract AF33(600)-35026.

Connectors are widely used in airborne electronic equipment and are especially useful during reactor tests of other components. The performance characteristics of existing connectors were tested to determine which types would be reliable in a reactor environment. The connectors chosen for this test were manufactured by Bendix Scintilla Division in conformance with MIL-C-5015C series K. The connectors use Mycalex insulation backed with a silicone rubber gasket and have a stainless steel shell. The ends were filled with epoxy resin as a potting material to seal out moisture and eliminate air paths. The connectors were tested for corona ignition and extinction voltage, leakage resistance, and pin contact resistance change. The corona voltages and leakage resistances were found to vary considerably, apparently independent of flux or total dose. (auth)

1877 BSR-16

Bendix Aviation Corp. Bendix Systems Div., Ann Arbor, Mich.

NUCLEAR IRRADIATION OF SCINTILLA SAMICA CAPACITORS. Dec. 1958. 42p. Contract AF33(600)-35026.

A group of 12 capacitors was irradiated in the Ford Nuclear Reactor at The University of Michigan. The capacitors, manufactured by the Scintilla Division of Bendix Aviation Corporation, were 0.12 μfd, 500 VDC units, and contained a synthetic mica dielectric. These capacitors were irradiated to an integrated flux of 5.65×10^{15} epicadmium neutrons/cm^2. A typical flux value during the irradiation was 6.2×10^9 epicadmium neutrons/cm^2/sec. Pre-irradiation, in-pile, and post-irradiation measurements were made on capacitance value, dissipation factor, and leakage resistance. Conclusive results were obtained from the test. Capacitance values remained virtually constant throughout irradiation. Dissipation factor values changed only in negligible amounts. Values of leakage resistance during the irradiation ranged from approximately 5×10^9 ohms to 10^{10} ohms. Leakage resistances showed very little change between pre- and post-irradiation measurements. (auth)

1878 BSR-17

Bendix Aviation Corp. Bendix Systems Div., Ann Arbor, Mich.

NUCLEAR IRRADIATION OF GOOD-ALL MYLAR CAPACITORS. Test Report. Oct. 1958. 36p. Contract AF33 (600)-35026.

A group of Mylar capacitors were subjected to irradiation in the Ford Nuclear Reactor at the University of Michigan. The capacitors were 0.22 ufd, 300 vdc units manufactured by Good-All Electric Manufacturing. The components were irradiated to an integrated flux of 6.57×10^{15} epicadmium neutrons. Typical flux values were 6.2×10^9 and 6.2×10^{10} epicadmium neutrons/cm^2/sec. Pre-irradiation, in-pile, and post-irradiation measurements made included dissipation factor, d-c leakage resistance, and capacitance value. Conclusive results were obtained. All capacitors showed negligible changes in capacitance. Dissipation factors changed only slightly. Leakage resistance dropped from above 10^{14} ohms to about 8×10^8 ohms at 100 kilowatt reactor power and about 2×10^8 ohms at one megawatt reactor power during irradiation. Post tests indicated that, after cessation of irradiation, leakage resistance values rose to about 3×10^{11} ohms. (auth)

1879 NAVORD-6276
Naval Ordnance Lab., White Oak, Md.
NUCLEAR RADIATION EFFECTS IN PERMANENT MAGNETS. R. S. Sery, D. I. Gordon, and R. H. Lundsten.
Apr. 13, 1959. 32p.

Permanent magnets exposed to 10^{17} fast nvt at 90°C in the BNL Reactor showed no measurable changes in magnetic properties. The materials irradiated were: 3½ Cr Steel, 36 Co Steel, Alnico II, V, and XII, Cunico, Cunife, Silmanal, fine irons, platinum-cobalt, and oriented and unoriented barium ferrites. Pre- and post-irradiation measurements of (a) demagnetization curves and (b) open magnetic circuit induction were made. Unirradiated controls, held at 90°C for 12 days were also measured. Because of induced radioactivity in the irradiated samples, post-irradiation measurements were made remotely, using the NRL hot-cell facility. (auth)

1880 NRL-5321
Naval Research Lab., Washington, D. C.
THE EFFECTS OF NUCLEAR IRRADIATION UPON THE MICROWAVE PROPERTIES OF CERTAIN FERRITES.
N. G. Sakiotis, E. I. Salkovitz, and A. I. Schindler.
Apr. 15, 1959. 10p. Project NE 120-000-27.

Results of the initial phases of a program to study the effects of high-energy neutron bombardment on the microwave properties of a wide variety of ferrite materials indicate that Faraday rotation and insertion loss can be changed by irradiation. It is also clear that these changes are not permanent but will vary with time. In the great majority of cases, the amount of Faraday rotation exhibited by the ferrite samples changed by a substantial amount immediately after irradiation but returned to the value observed before irradiation in at most 148 days. The effects of irradiation upon the losses of the ferrites are more complicated. Significant changes in the loss at high-power levels have been observed 199 days after removal from the reactor in the case of magnesium–manganese ferrites and after 148 days in the case of nickel–manganese–copper and nickel–cobalt–aluminum samples. For the magnesium–manganese and nickel–cobalt–aluminate materials, it has been observed that the materials which were formed at a low firing temperature (1250°C) showed an increase in their high-power loss, which in most cases appears to be permanent. It has also been observed that a large substitution of aluminum for the iron in the nickel–cobalt ferrite can result in a large increase in rotation accompanied by large decreases in both low- and high-power losses when the material is subjected to neutron irradiation. (auth)

1881 TID-3538
Technical Information Service Extension, AEC.
RADIATION EFFECTS ON SELECTED STRUCTURAL METALS. A Literature Search. William E. Bost, comp.
Nov. 1959. 17p. OTS.

This bibliography includes 143 references to reports and published literature on radiation effects on aluminum and aluminum alloys, brass, copper, carbon, and stainless steel. A few reports on radiation effects measurements and mechanisms for metals in general are included. (J.E.D.)

1882
RADIATION EFFECTS ON MATERIALS AND SYSTEMS. Richard E. Bowman and Carl J. Lyons (Battelle Memorial Inst., Columbus, Ohio). Battelle Tech. Rev., 7p. (1959) Oct.

The effects of nuclear radiation on various materials are discussed, and the interrelations of these effects in a system are pointed out. (T.R.H.)

1883
STUDY OF IRRADIATED SOLIDS. Bull. inform. sci. et tech. (Paris) No. 31, 85-92(1959) July-Aug. (In French)

The use of fast neutrons in studying the physical properties of solids is discussed. Irradiation and dosimetry techniques used in such a study are described. Work using these techniques on graphite, alkali halides, and ordered alloys is reported. (T.R.H.)

1884
STUDY OF SOLIDS USING SLOW NEUTRONS. Bull. inform. sci. et tech. (Paris) No. 31, 93-103(1959) July-Aug. (In French)

Crystal spectrometers and time-of-flight spectrometers are described, and their use in studying solids by means of slow neutrons is discussed. (T.R.H.)

1885
ANNEALING STUDY ON A PILE IRRADIATED CRYSTAL. R. C. Hall, W. S. Byrnes, and R. G. Crawford (Westinghouse Electric Corp., East Pittsburgh, Penna.). J. Appl. Phys. 30, 1846-7(1959) Nov.

The results of anisotropy measurements for an irradiated aluminum–iron crystal are reported. (J.E.D.)

1886
ON THE VISCOSITY OF IRRADIATED POLYMERS, II. Mitio Inokuti and Kanji Katsuura (Univ. of Tokyo). J. Phys. Soc. Japan 14, 1379-85(1959) Oct.

The intrinsic viscosity of a polymeric substance crosslinked as well as degraded by irradiation with high-energy radiations is discussed for various types of initial molecular size distributions. The intrinsic viscosity as a function of radiation dose is shown to behave in a great variety of ways depending on the relative importance of crosslinking and degradation, and in particular, on the shape of the initial distribution. The effect of endlinking instead of crosslinking is also examined. (auth)

1887
ENGINEERING DECISIONS BASED ON IRRADIATION EXPERIMENTS. J. H. Kittel and S. H. Paine (Argonne National Lab., Lemont, Ill.). Metal Progr. 76, No. 5, 119-22(1959) Nov.

A discussion is given on the importance of irradiation of experimental reactor parts prior to engineering design. Illustrations of these necessary experiments are discussed for the Daniel's Pile, Fast Breeder Reactor, Boiling Water Reactor, and Borax-IV. (C.J.G.)

1888
EFFECT OF NEUTRON IRRADIATION ON THE MARTENSITE TRANSFORMATION IN IRON–NICKEL ALLOYS. L. F. Porter and G. J. Dienes (Brookhaven National Lab., Upton, N. Y.). Trans. Met. Soc. AIME 215, 854-63(1959) Oct.

The effect of neutron irradiation on martensite transformation in the iron–nickel system was studied by means of electrical resistance and magnetic induction measurements. Irradiation lowers the M_s temperature of the alloy, causes changes in the electrical and magnetic properties of the high-temperature phase which indicate either an acceleration of phase separation or a clustering of nickel, and enhances strain recovery on specimens partially transformed to martensite prior to irradiation. Possible mechanisms to account for the effects are discussed. (auth)

1889
THE EFFECT OF RADIATION ON THE RATE OF DIFFUSION OF ARSENIC INTO GERMANIUM. Norman L. Peterson and Robert E. Ogilvie (Massachusetts Inst. of Tech., Cambridge). Trans. Met. Soc. AIME 215, 873-4(1959) Oct.

A study was made of the radiation enhanced diffusion in solids. High-purity arsenic containing 30 ppm impurities was allowed to diffuse from the gaseous phase at 700°C into single crystals of p-type germanium containing 0.1 ppm of indium. As the arsenic diffused into the p-type germanium, an n-type layer formed in the diffusion zone. At the p-n junction the concentration ratio of the arsenic to the indium was constant. Experimental procedures are given. (J.E.D.)

PHYSICS

General and Miscellaneous

1890 AECU-4416
General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.
PULSED NEUTRON MEASUREMENTS ON PLEXIGLAS. Karl W. Seemann. June 15, 1959. 14p. OTS.

Presented at the Annual Meeting of the American Nuclear Society, Gatlinburg, Tenn.

Data on the time decay of the fundamental mode of the thermal neutron flux for a series of Plexiglas cylinders having diameters ranging from 11 to 2.4 in. and geometric bucklings ranging from 0.04 to 0.7 cm^{-2} are presented. Experimental techniques and results are discussed. (J.R.D.)

1891 AEDC-TN-59-51
University of Southern California, Los Angeles. Engineering Center.
ADDITION OF HEAT TO A GAS THROUGH ELECTRICAL DISCHARGE. Raymond L. Chuan. May 1959. 22p. Contract AF40(600)-736. (AD-215022).

The basic mechanisms present in a gaseous discharge and the subsequent decay are examined with the view toward applying these to heating a gas used for aerodynamic experiments. For the study of the thermodynamics and fluid mechanics of the flow of a partially ionized gas, the energy release due to decay processes is treated as a heat source moving with the gas, the source strength being related to the rate of decay of the energetic states of the excited molecules. The effects of the relaxation heating of the gas through the decays on the thermodynamics and dynamics of the gas flow are examined. (auth)

1892 AFOSR-TR-59-132
Michigan. Univ., Ann Arbor. Aircraft Propulsion Lab.
AN EXPERIMENTAL INVESTIGATION OF THE POSSIBILITY OF ACHIEVING A STANDING DETONATION WAVE. Final Report. J. A. Nicholls, E. K. Dabora, and R. S. B. Ong. July 1959. 28p. Contract AF18(600)-1199. (UMRI-2284-23-F).

The properties of gaseous detonation waves and the conditions that must be met to generate stable waves are described and discussed, as is the experimental facility which evolved as a result of these considerations. Preliminary experiments leading to the first known case of a stabilized detonation wave are also described. In these experiments an ignition time delay has been detected between the shock wave and onset of combustion. It appears that this experimental technique has great potential in the study of chemical kinetics as well as in the study of stabilized detonation waves. Preliminary analytical work on the stability of a plane detonation wave is discussed. (auth)

1893 AFOSR-TN-59-754
Cornell Univ., Ithaca, N. Y.
AN OPTIMIZED METHOD FOR CORRECTING FOR SMEARING ABERRATIONS: COMPLEX X-RAY SPECTRA. Technical Report No. 7. J. O. Porteus and L. G. Parratt. Sept. 1, 1959. 130p. Contract AF49(638)-402.

Studies were undertaken to determine the true spectrum $T(v)$ from the observed spectrum $O(v_n)$ which was recorded with a spectrometer whose smearing function is $M(v_n - v)$, and also to correct $O(v_n)$ for the smearing effect of $M(v_n - v)$. The correction involves the convolution or folding integral $O(v_n) = \int_{-D}^{\infty} T(v)\, M(v_n - v)\, dv$. The errors in this solution are discussed in detail. The specific spectral examples to which the new method is applied are the K emission and absorption of crystalline KCl. (W.L.H.)

1894 BNL-563
Brookhaven National Lab., Upton, N. J.
COLLISION PROBABILITIES AND RESONANCE INTEGRALS FOR LATTICES. Wolfgang Rothenstein. June 1959. 17p. OTS.

A formula for the escape probabilities of neutrons from the fuel lumps to the moderator and vice versa in a lattice is derived, and the validity of simple approximations is discussed. These expressions are applied to solve the coupled integral equations for the collision densities in a lattice. First-order corrections to the resonance integral are obtained both for the Narrow Resonance and for the Narrow Resonance Infinite Absorber approximations. Numerical results are given for water lattices containing hexagonal arrays of U^{238} rods, of 0.25 and 0.60-in. diameter, at different water to metal volume ratios. (auth)

1895 CRIO-865
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
MEASUREMENT OF THE STORED ENERGY IN THE NRX REACTOR REFLECTOR GRAPHITE. H. B. Hilton and E. A. G. Larson. July 1959. 26p. (AECL-889). AECL.

The stored energy content of the inner reflector graphite of NRX was measured at three different elevations and at different positions through the reflector. It was shown that there was no danger to NRX from an accidental release of energy. The rate of stored energy release versus annealing temperature is shown. (J.E.D.)

1896 CU-195
Columbia Univ., New York.
OPTICAL SPECTRA EXCITED IN THE NOBLE GASES AT HIGH PRESSURES BY POLONIUM ALPHA PARTICLES (thesis). William R. Bennett. Jr. May 20, 1959. 83p. Contract AT-30-1-GEN-72. OTS.

A study was made of the light emitted by noble gases in the range from 2500 to 5500A when excited with polonium alpha particles. The atomic spectra observed are interpreted through the dominant processes of direct excitation by alpha and electron impact, trapping of vacuum ultraviolet resonance radiation, and excitation transfer effects resulting from two-body collisions with ground state atoms. Nitrogen impurity bands dominated the spectra in most He, Ar, and Ne samples used. (W.D.M.)

1897 CWL-SP-4-12
THE MECHANICS OF AEROSOLS. N. A. Fuks. Trans-

lated by E. Lachowicz from a publication of the Academy of Sciences of the U.S.S.R., Institute of Scientific Information, 1955. 461p. OTS.

The volume consists of eight chapters. In chapter one the dimensions and shape of particles in aerosols are discussed. The second chapter is devoted to the uniform motion of aerosol particles. The third chapter examines the irregular motion of aerosol particles. The fourth chapter discusses curvilinear motion of aerosol particles. In chapter five Brownian movement and diffusion of aerosols are investigated. Chapter six discusses convective and turbulent diffusion in aerosols. Chapter seven is devoted to the coagulation of aerosols. In the last chapter the transformation of powdery substances into the aerosol stage is described. (W.L.H.)

1898 HE-150-166

California. Univ., Berkeley. Inst. of Engineering Research.

NEW STUDIES OF MOLECULAR SCATTERING AT THE SOLID SURFACE. F. C. Hurlbut and D. E. Beck. Aug. 11, 1959. 37p. Contract Nonr-222(45).

A molecular beam apparatus is used to study the physics of interaction at the gas surface interface. The spatial distributions of the flux of particles scattered from various surfaces are presented. Data are presented for the scattering of argon atoms and nitrogen molecules from teflon, glass, cleaved crystals of zinc and lithium fluoride, and liquid metal surfaces of gallium and indium. (auth)

1899 HW-60662

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

LAMB WAVES AT ULTRASONIC FREQUENCIES. D. C. Worlton. June 9, 1959. 58p. Contract W-31-109-Eng-52. OTS.

A theory formulated in 1916 by Horace Lamb predicting that plates may vibrate up to an infinite number of modes is confirmed by a method described. Measurements made on finite plate and curved objects reveal that in each case the wave phase velocity agrees closely with predicted values. The theory is extended to correlate experimental observations. Equations are developed relating phase velocity to frequency and plate thickness in terms of longitudinal and shear wave velocity. Curves are presented for aluminum, zirconium, stainless steel, brass, and uranium. The distinguishing characteristics of the various modes are discussed in the light of potential nondestructive testing applications. It is shown that interior particles are displaced in elliptical orbits, with vertical motions existing at the surfaces when the wave velocity is $\sqrt{2}$ shear wave velocity, and horizontal surface motions existing for wave velocities equal to longitudinal wave velocity. (auth)

1900 IFA/FT/31

Academia R. P. R. Institutul de Fizică Atomică, Bucharest.

RELATIVISTIC K-SHELL PHOTOEFFECT. (Efectul Fotoelectric Relativist în Pătura K). Mihai Gavrila. 1959. 38p.

The expressions of the relativistic K-shell photoeffect cross sections, correct to first order in αZ (inclusive), are established. For this purpose a second order calculation must be carried out, that is, electronic spinors correct to second order in αZ must be employed in the matrix element. The final continuum state spinor of the electron, whose exact analytic form is not known, is described by means of the Born approximation. To avoid the divergences, peculiar to the application of this method to the pure Coulomb field, the case of the screened potential is considered at the beginning. The matrix element, which is evaluated in momentum space, remains singular in the limit of no screening. Nevertheless, it is shown that the differential cross section, as issuing from a very laborious trace evaluation, is in first order finite in this limit and has the behavior one would expect. Indeed. the zero order approximation in αZ coincides with Sauter's formula, as it should. Further, in the nonrelativistic and extreme relativistic limits the cross section reduces to results established by other means. (auth)

1901 JEN-15

Spain. Junta de Energia Nuclear, Madrid.

DIFFRACTION DES NEUTRONS LENTS PAR LES POUDRES MICROCRISTALLINES D'UO_2 ET DE CeO_2. (Diffraction of Slow Neutrons by Microcrystalline Powders of UO_2 and CeO_2). F. Verdaguer, C. Sanchez Del Rio, R. Keller, and A. Kind. 1956. 9p.

Transmission measurements were made with monokinetic neutrons in microcrystalline powders of UO_2 and CeO_2. The theoretical study of the cross section curves as a function of the wave length associated with the neutrons permits a determination of the value and sign of the scattering amplitude of uranium and cerium. (tr-auth)

1902 JEN-16

Spain. Junta de Energia Nuclear, Madrid.

EFECTO DE ORIENTACIÓN EN LAS ACTIVIDADES DE SONDAS NEUTRÓNICAS. (Orientation Effect in the Activities of Neutron Probes). Maria De Aranzazu Vigon. 1956. 10p.

The formulas relating activity and position of a neutron irradiated indium foil were verified experimentally. Measurements with both thin and thick foils for epithermal neutrons and with thick foils for thermal neutrons were carried out. The experimental results agree qualitatively with the theoretical predictions. (auth)

1903 JEN-17

Spain. Junta de Energia Nuclear, Madrid.

SOBRE LA MEDIDA ABSOLUTA DE ACTIVIDADES BETA. (The Absolute Measurement of Beta Activities). C. Sanchez Del Rio, Oscar Jimenez Reynaldo, and E. Rodriguez Mayquez. 1956. 7p.

A new method for the absolute beta counting of solid samples is given. The measurements are made with an inside Geiger-Müller tube of new construction. The backscattering correction, when using an "infinite" thick mounting, is discussed and results for different materials given. (auth)

1904 JEN-19

Spain. Junta de Energia Nuclear, Madrid.

MEDIDA DE LA INTENSIDAD ABSOLUTA DE UNA FUENTE DE NEUTRONES. (Measurement of the Absolute Intensity of a Neutron Source). E. Rodriguez Mayquez and C. Sanchez Del Rio. 1956. 8p.

The absolute intensity of a Ra-Be neutron source was measured. The source contains 500 milligrams of radium plus 5 grams beryllium and produces $(5.85 \pm 0.76 \times 16^6$ neutrons/sec. The experimental procedures are described and the result discussed and compared with those of similar determinations. (auth)

1905 JPLAI/SURVEY/1B

California Inst. of Tech., Pasadena. Jet Propulsion Lab.

ASTRONAUTICS INFORMATION. OPEN LITERATURE SURVEY—VOL. 1, PART B, (ENTRIES 11,576–12,483). Sept. 15, 1959. 74p. Contract NASw-6.

The material presented is organized alphabetically according to subject. An author index is included at the end of this volume. A list of periodicals surveyed for material for inclusion is presented. (W.L.H.)

1906 NAA-SR-4039

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

BOUNDARY PERTURBATION THEORY APPLIED TO A BARE TRUNCATED SPHERE. J. J. McClure. Oct. 15, 1959. 16p. Contract AT-11-1-GEN-8. OTS.

Boundary perturbation theory is used to find the geometric buckling in first and second order for a bare truncated spherical reactor in the one energy group diffusion theory approximation. The unperturbed system is the full sphere; the perturbed system is a sphere from which a spherical segment has been removed. The results are given as a function of the degree of truncation, i.e., the height above the center of the sphere where the segment is removed. The results indicate that the void coefficient of a homogeneous, spherical water boiler reactor decreases in magnitude as the level of the liquid is increased; however, it does not change sign. It is concluded that such a reactor cannot become supercritical due to the introduction of voids alone. This is in contrast to some previous results. The approximations inherent in this calculation tend to overestimate the decrease in void coefficient as a function of liquid level so that such an effect in a reflected reactor cannot be larger than calculated. However, this effect should be recognized in a detailed analysis of spherical water boiler transient experiments. (auth)

1907 NAA-SR-Memo-4327

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

CALCULATIONS WITH MULTIGROUP ADJOINTS. F. H. Clark. Sept. 2, 1959. 10p. OTS.

1908 NARF-59-31T

Convair, Fort Worth, Tex.

GAMMA DOSE RATES RESULTING FROM NEUTRON CAPTURE IN AIR AND CONCRETE. M. B. Wells. Sept. 1959. 70p. Project 6(1-9964). Contract AF33(600)-32054. (MR-N-238).

A Monte Carlo method of obtaining the angular distribution of the gamma dose rate resulting from capture of slow and thermal neutrons in air and concrete is described. The results of some air-capture calculations are compared with analytic solutions of the Boltzmann transport equation and similar Monte Carlo calculations made at the Oak Ridge National Laboratory. The results of a parameter study of the capture dose rate for thermal-neutron line-beam sources are given for source-detector separation distances of 38.81, 64.00, and 98.42 feet, and a source-detector height of 12.5 feet above a concrete surface. The calculations show the significance of the component of the capture gamma dose rate resulting from neutrons that undergo their first n collisions in one medium and then diffuse into the other medium. (auth)

1909 NAVORD-6663

Naval Ordnance Lab., White Oak, Md.

A SURVEY OF BASIC RESEARCH IN THERMOELECTRICITY. Wayne W. Scanlon. June 1, 1959. 14p. (AD-220241).

The status of research in the general area of thermoelectricity was surveyed. Thermoelectric effects were considered in metals and insulators as well as in semiconductors. It is apparent that even in the simplest monatomic metals, the theory is unable to account qualitatively or quantitatively for the observed behavior. Wide discrepancies are found in some metals which are generally believed to approximate closely the ideal free electron behavior. In semiconductors and insulators the agreement between theory and experiment is better for a few materials like Ge and Si for which essential information on band structure, scattering processes for electrons and phonons, and density of carriers are known. However, understanding of thermoelectric effects in most semiconductors is limited due to insufficient information on their properties. The behavior of a group of low mobility semiconductors in which conduction is by a jump process is not well understood, and much research remains in this area. (auth)

1910 NP-8015

Detroit. Univ.

THE STUDY OF PROPERTIES OF SINGLE CdS AND ZnS CRYSTALS FOR USE AS DETECTORS IN CRYSTAL COUNTERS. Technical Report No. 5. S. J. Czyzak, H. Payne, R. C. Crane, and W. M. Baker. Oct. 1, 1959. 37p. Project NR-015-218. Contract Nonr-1511-(01).

Progress is reported on the theoretical and experimental study of the properties of single crystals for use as detectors and counters. (For preceding period see NP-7024.) (W.L.H.)

1911 NP-8023

Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.

X-RAY DIFFRACTION STUDIES OF THERMAL MOTIONS IN CRYSTALS. Annual Report No. 1 [for] June 1, 1958 to May 31, 1959. R. A. Young. 184p. Project No. A-389. Contracts NOnr 991(00) and 991(06).

The general problem is the study, by x-ray means, of thermal vibrations of the atoms in crystals and their interactions with other phenomena of interest in crystal physics. The first experimental studies deal with the temperature dependences of the motions in AgCl as revealed by their effect on the Bragg intensities. Extended consideration was given to the background of the problem as found in the theory of and the literature on thermal motions of atoms, or lattice vibrations, as related to x-ray measurements of Bragg intensities. A method for determining temperature factors (hence Debye-Θ's) from temperature dependences of x-ray intensities is derived and experimentally illustrated. A second method is suggested. Effects on the data of such things as thermal diffuse scattering (TDS), temperature dependence of primary extinction, and defect concentration are considered in some detail. Possibilities for assessing or studying the same factors through their effects on the apparent Bragg peaks are noted. Equipment design and performance, design of experiments, experimental techniques, and characteristics of the specimen, etc. are discussed in detail, especially in connection with accuracy and reproducibility. Particular attention has been given to means for shaping the specimens without distorting them. A conceptual device referred to as the acceptance region model was developed and utilized to determine the requirements on and the factors affecting the x-ray beam geometries. Intensity data were collected for (hhh), (hhO), and (hOO) reflections of AgCl at 10-degree intervals at 90 to 300°K. Variations in diffraction peak breadths with temperatures were observed and are discussed. Reproducibility in the intensity vs. temperature measurements was of about 0.5 to 0.75%. The amplitudes of thermal motions of the silver and chlorine atoms were found to be similar, and in agreement with observations by others. This result is interpreted to mean that the acoustic (rather than optical) modes of lattice vibrations have dominant importance to x-ray observations of the present type in AgCl. An inflection in the semi-log plot of intensity vs. temperature was found in the case of the (111) reflection. The possibility that the inflection may indicate a temperature induced change in bond character will be investigated. The errors introduced by TDS and α-doublet separation (both of which are temperature dependent) in the measures of Bragg intensities vs. temperature were partially overcome by a technique involving extrapolation to $\sin \theta = 0$. Evidence for anisotropy in the thermal motions of the atoms in AgCl was not conclusive, and further effort will be expended definitely to support or to reject present indications of anisotropy. Existence of anisotropy would probably indicate anharmonic thermal vibrations. Approximate Debye-Θ's have been determined from the intensity vs. temperature data which are in reasonable agreement with literature values obtained by other means. The general technique of extracting crystal-physics information from careful measurements of the temperature dependence of the Bragg intensities continues to show promise. (auth)

1912 ORNL-2850
Oak Ridge National Lab., Tenn.
STUDIES OF THE SPHERICAL HARMONICS METHOD IN NEUTRON TRANSPORT THEORY. III. DISTRIBUTION OF THE ROOTS OF THE CHARACTERISTIC EQUATION IN THE CASE OF ANISOTROPIC SCATTERING. Walter Kofink. Nov. 6, 1959. 33p. Contract W-7405-eng-26. OTS.

1913 PR-P-42
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
PHYSICS DIVISION. PROGRESS REPORT APRIL 1, 1959 TO JUNE 30, 1959. 81p. (AECL-888). AECL.

A study of the conversion lines accompanying the decay of Eu^{156} and Tb^{160} was carried out with the $\pi\sqrt{2}$ beta spectrometer and the results together with gamma coincidence measurements lead to level schemes for the daughter nuclei Gd^{156} and Dy^{160}. The accurate level energies and gamma relative intensities lend support to the nuclear model due to Davydov and Filippov. A program of study of proton capture reactions was undertaken in an effort to gain insight into the phenomena of the giant nuclear resonance universally observed in photonuclear reactions. The gamma yield from the $B^{11}(p,\gamma)$ reaction was measured for proton energies of 3 to 11.4 Mev. The gamma transition to the ground state of C^{12} exhibits a giant resonance at a proton energy of 7.1 Mev with a width of 2.9 Mev. The neutron yield from the proton bombardment of B^{11} was also studied. A study is being carried out on the $Al^{27}(p,\gamma)$ and (p,n) reactions. The 3-Mev electrostatic accelerator was used with a doubly-ionized He^4 beam to study the reaction $Mg^{26}(\alpha,n\gamma)Si^{29}$ at He^4 energies between 4.5 and 5.0 Mev. The angular correlations of the γ-rays were measured in coincidence with the neutrons emitted at 0° to the He^4 beam. Extensive measurements of the energy and angular distributions of neutrons scattered from liquid lead at a temperature of 340°C were carried out. Measurements on liquid helium were also accomplished. Calculations of the U^{235} burn-up, plutonium content, and the isotopic composition of the plutonium in natural uranium fuel irradiated in the NRX were carried out using basic cross section data and compared with experimental measurements on samples cut from irradiated NRX fuel rods. The disposal of radioactive waste by incorporation into glass and burying the glass in normal ground is discussed. Studies of equipment failures showed that mechanical failures such as soldering, sockets, etc. are becoming the dominant source of trouble in new equipment. As a consequence improved methods of construction are being developed. The widespread application of complex data handling equipment has resulted in a change in the mode of operation of the electronic maintenance group. Electronic equipment needed in the control and safety system for NPD is discussed. (For preceding period see PR-P-41.) (W.D.M.)

1914 RM-2404-AEC
RAND Corp., Santa Monica, Calif.
RELATIVISTIC SELF-CONSISTENT CALCULATION FOR THE NORMAL TUNGSTEN ATOM. Stanley Cohen. June 30, 1959. 58p. Contract AT(11-1)-135, Project Agreement No. 5. OTS. Also issued as UCRL-8634, Apr. 21, 1959.

The relativistic self-consistent solution for the normal tungsten atom is presented. A comparison is made between the energy eigenvalues for each of the subshells with corresponding experimentally determined energy-term values. (auth)

1915 RM-2405-AEC
RAND Corp., Santa Monica, Calif.
RELATIVISTIC SELF-CONSISTENT CALCULATION FOR THE NORMAL PLATINUM ATOM. Stanley Cohen. June 30, 1959. 60p. Contract AT(11-1)-135, Project Agreement No. 5. OTS. Also issued as UCRL-8635, Apr. 21, 1959.

The relativistic self-consistent solution for the normal platinum atom is presented. A comparison is made between the energy eigenvalues for each of the subshells with corresponding experimentally determined energy-term values. Results are tabulated. (auth)

1916 SCTM-206-54(54)
Sandia Corp., Albuquerque, N. Mex.
DETERMINATION OF RADAR-CROSS-SECTION FOR A SCATTERING GROUND. R. A. Hessemer, Jr., and C. S. Williams, Jr. Sept. 22, 1954. 20p. OTS.

The mean pulse returned from a random scattering ground can be expressed as an integral where the integrand is a function of the radar cross section. The receiver modifies the returned pulse but under certain conditions the effects due to the ground and the receiver can be interchanged so that it is only necessary to examine the mean pulse at receiver output and an equivalent transmitted pulse to find the ground radar cross section. (auth)

1917 USNRDL-TR-357
Naval Radiological Defense Lab., San Francisco.
GROUND-TO-AIR TRANSMISSION OF VISIBLE AND NEAR INFRARED RADIATION FROM A 4-Pi SOURCE. M. G. Gibbons, R. L. Rudkin, J. R. Nichols, F. I. Laughridge, R. L. Sturgis, and R. J. Krenik. July 16, 1959. 36p.

Attenuation coefficients were measured at altitudes of up to 20,000 ft and slant ranges of up to 63,000 ft for radiation from a near-ground-level 4-pi source. A large flash-lamp surrounded by a frosted globe was used as the source. The receivers, carried by a P2V-5F aircraft, consisted of a total of twelve combinations of Wratten filters and photomultiplier tubes, with six photomultipliers being used at any one time and feeding into three dual trace oscilloscopes, the screens of which were photographed. Peak responses of the combinations were at 0.40, 0.50, 0.70, 0.83, and 0.90 μ. Fields of view of the receivers ranged from 15 to 84 degrees half-angle, with occulters blocking out the direct radiation in some of the receivers so that measurements of the ratio of directly to indirectly received radiation could be made for various fields of view. Data are presented on this ratio and on attenuation coefficients for the cases of clear and hazy atmospheres. (auth)

1918 AEC-tr-3798
STATICS OF THIN-WALLED ELASTIC SHELLS. (Statika Tonkostennykh Uprugikh Obolochek). A. L. Lur'e. Trans-

lated by Benjamin Skolnikoff from a publication of the State Publishing House of Technical and Theoretical Literature, Moscow—Leningrad, 1947. 214p. OTS.

This volume is divided into four chapters. In the first chapter the equilibrium equations of an elastic, symmetrically loaded shell of revolution are discussed. Chapter two deals with the solution of the fundamental differential equations for shells of the simplest geometrical shape. In the third chapter the approximate solution of the fundamental differential equations of a symmetrically loaded shell of revolution is presented. The last chapter deals with arbitrarily loaded cylindrical shells. (W.L.H.)

1919 AEC-tr-3880

USE OF THE METHOD OF MODULATED MOLECULAR BEAMS FOR INVESTIGATION OF ADSORPTION PHENOMENA. S. V. Starodubtsev. Translated by Lydia Venters (Argonne National Lab.) from Zhur. Ekspt'l. Teoret. Fiz. 19, 215-24(1949). 20p. JCL or LC.

The use of modulated atomic or molecular beams conducted to the adsorbing filament is suggested for measurement of the evaporation probability of adsorbed atoms from the surface of incandescent metals. The change in filament positive ion flux time is used to determine the adsorbed atom evaporation probability rate, and the heat of ion and atom evaporation. Data are included on adsorption of K and Na on W. (J.R.D.)

1920 NP-tr-302

STORAGE OF COLD NEUTRONS. Ya. (Ia.) B. Zel'dovich. Translated by R. P. Illwitzer (Johns Hopkins Univ.) from Zhur. Ekspt'l. Teoret. Fiz. 36, 1952-3(1959). 4p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 18455.

1921 NP-tr-307

ONE-DIMENSIONAL UNSETTLED MOTIONS OF A GAS. L. I. Sedov. Translation of p.161-320, Chap. IV, of Metody Podobiya i Razmernosti v Mekhanike, Moscow, 1957. 202p. OTS.

Gas motions, the characteristics of which depend on a single geometrical coordinate and on time are examined. The solutions of certain problems associated with one-dimensional unsettled motions of a compressible fluid or gas may be found by using the dimensional theory. The unknown functions and the determining parameters of one-dimensional motions are considered in describing problems which can be solved by methods of dimensional analysis. Several examples of problems (called automodel-type) which can be solved by these methods are presented. (J.R.D.)

1922 TT-831

THE INFLUENCE OF ANHARMONICITY ON THE PROPERTIES OF CRYSTALS. (Über den Einfluss der Anharmonozität auf die Eigenschaften der Kristalle). W. Ludwig. Translated by D. A. Sinclair (National Research Council of Canada) From Phys. and Chem. Solids 4, 283-305(1958). 50p.

In the lattice theory of crystals one generally assumes the validity of the harmonic approximation, in which only quadratic terms are taken into account in the expansion of the potential energy in the displacements. The influence of higher terms (anharmonicity) is investigated, and a particular example (face-centered cubic lattice with central forces between nearest neighbors only) is discussed. The free energy, from which all the thermodynamic properties of a crystal may be evaluated, is computed with the aid of a method analogous to the Dirac perturbation theory. It is possible to deduce general theorems for the temperature dependence of the isothermal and adiabatic elastic constants. In no case are the Cauchy relations satisfied. It is also possible to derive relatively simple expressions for the contributions to the specific heat arising from anharmonicity. It is shown in particular that the relation between elastic data and Debye temperature derived in the harmonic approximation is not valid even at absolute zero. An expression is also derived for the velocity of elastic waves, taking anharmonicity into account. The relation between the wave velocity and the elastic constants is discussed. It appears from this that the relations deduced for cubic crystals are valid only for transverse waves. The simple example discussed would be valid for rare gases in the solid state, for which, however, only very scanty experimental data exist. (auth)

1923 TT-834

MAXIMA OF THERMODYNAMIC PROPERTIES AND THE TRANSITION OF GAS TO LIQUID IN THE SUPRACRITICAL REGION. (Maksimumy Termodinamicheskikh Svoistv i Perekhod ot Gaza k Zhidkosti V Nadkriticheskoi Oblasti). M. G. Kaganer. Translated by G. Belkov (National Research Council of Canada) from Zhur. Fiz. Khim. 32, 332-9 (1958). 20p. NRC or JCL.

The maxima of isobaric and isochoric heat capacities and of the isothermal throttle effect in the supracritical region were located. The line of maxima isobaric heat capacities on the isobars and maxima isochoric heat capacities on the isochors is a natural prolongation of the saturated vapor pressure curve and passes over to the isotherm at $\tau \approx 1.21$. In the vicinity of this line the transition from gas to liquid or, to be more exact, the intensive formation of associated molecular complexes takes place. The pressure dependence of the density along the lines of the maxima was explained. The density on the line $(\partial C_p/\partial p)_T = 0$ increases uniformly with the pressure rising to a value $\rho = 1.55$ at $\pi = 25$. In coordinates of density and pressure the line $(\partial \delta/\partial p)_T$ is a natural prolongation of the linear diameter of liquid and gas densities in the saturation region. Along the lines of maxima isobaric heat capacities and isothermal throttle effects on the isotherms the reduced values of these quantities $(C_p - C_pO)/R$ and δ/v_c are directly proportional to the quantity $1/(\tau-1)$. Along the lines of maxima heat capacities and throttle effect maxima on the isobars the reduced values are linearly related to the quantity $1/(\pi-1)$. These relationships hold for the entire region of states investigated up to the highest temperatures and pressures. (auth)

1924 XDC-59-9-148

THE CONDITION OF MATTER AT HIGH TEMPERATURES AND HIGH PRESSURES. E. Hautzsche and L. W. Wieczorek. Translated by J. Fred White (General Electric Co. Aircraft Nuclear Propulsion Dept.) from Priroda 47, No. 10, 41-7(1958). 14p. JCL or LC.

The properties of matter are changed with changing temperature and pressure. The concept of temperature is reviewed. The dependency of properties of matter on temperatures to 10^{14}°K and the dependency of the state of matter on pressures to 10^{27} atmospheres are discussed. The origin of high temperatures and pressures is considered. (W.D.M.)

1925

ELASTIC AND INELASTIC SCATTERING CROSS-SECTIONS. James W. Albrecht (Univ. of Chicago). Anales real soc. españ. fís. y quím (Madrid), Ser A 55, 223-6(1959) July-Aug.

An expression is obtained for elastic and inelastic cross-sections by expressing both in terms of the same matrix elements. (C.J.G.)

1926

ON THE DESIGN AND USE OF STRONG RADIATION SOURCES. A. V. Bibergal, M. M. Korotkov, and T. G. Ratner. Atomnaya Energ. 7, 244-51(1959) Sept. (In Russian)

Experimental studies were made of the cumulative effect of radiation from Co^{60} and Cs^{137} point sources at short distances. Practical calculations (for the case of barrier geometry with comparably small absorption layer thickness) are accomplished using published data on homogeneous infinite media. Dosage equalization was achieved by means of filters. It is suggested that in irradiations of objects with thicknesses up to 40cm and densities ≤1, Ce^{137} is more effective than Co^{60}. (tr-auth)

1927

A NEW GRAPHICAL METHOD FOR CALCULATING THE DOSE FIELDS OF EXTENDED SOURCES. A. V. Bibergal. Atomnaya Energ. 7, 281-4(1959) Sept. (In Russian)

The suggested generalized calculation method for dose fields from extended sources eliminates the necessity of numerical integration and derives, with fixed precision, approximate expressions as elementary or tabulated functions. The method is used for calculating doses from sources of various configurations: the source with infinitely fine rectangular plane of infinite dimensions, the plane source of elliptic shape, and linear sources. (R.V.J.)

1928

THERMALIZATION OF NEUTRONS. Bull. inform. sci. et tech. (Paris) No. 31, 27-9(1959) July-Aug. (In French)

Two distinct phases in the life of a neutron in a thermal reactor are considered, the slowing down and the diffusion. Thermalization in infinite homogeneous media and in finite media are studied separately. (T.R.H.)

1929

CONTROL OF MATERIALS. Bull. inform. sci. et tech. (Paris) No. 31, 32-3(1959) July-Aug. (In French)

The oscillator method for nuclear material control is discussed. It is used on graphite, Be, BeO, Th, and Al at Fontenay—aux—Roses. Proposed equipment for further utilization of the method is described. (T.R.H.)

1930

STUDY OF THE LIGHT EMITTED IN THE MODERATOR OF A HEAVY WATER REACTOR. Bull. inform. sci. et tech. (Paris) No. 31, 34-5(1959) July-Aug. (In French)

A study is described—the object of which was to determine if light from reactors of the type at Fontenay—aux—Roses is due to the Cherenkov effect. (T.R.H.)

1931

EFFECT OF TEMPERATURE ON PREDISRUPTIVE CURRENTS IN COMPRESSED GASES. André Boulloud (Laboratoire de Hautes Tensions, Bellevue, [France]). Compt. rend. 249, 1202-4(1959) Oct. 5. (In French)

Experiments are reported which show a rapid increase of the intensity of predisruptive currents with temperature increases. The measurements were made between parallel metal plates and at pressures of the order of tens of atmospheres. (T.R.H.)

1932

OAK RIDGE GASEOUS DIFFUSION PLANT REPORTS ON 15 YEARS OF PROCESS MASS SPECTROMETRY. B. J. Bogardus and J. R. Mahoney (Oak Ridge Gaseous Diffusion Plant, Tenn.). ISA Journal, 6p.(1958) Aug.

The development of the Nier spectrometer from a glass lab-type instrument to the present practical, rugged versatile device is described. The instrument now used is completely automatic, easily operated and serviced, and is adaptable for remote control. (T.R.H.)

1933

SOME EFFECTS OF LOW FIELDS ON LUMINESCENCE OF CdS. C. E. Bleil and D. D. Snyder (General Motors Research Labs., Warren, Mich.). J. Appl. Phys. 30, 1699-1702(1959) Nov.

The effects produced on luminescence and conductivity in pure CdS crystals by application of electric fields up to ~1000 v/cm are reported. A shift in the red and green cathodoluminescence peaks of ~0.1 A/v/cm is observed. After application of the low fields, some crystals required over 90 minutes to recover their "prefield" luminescence. Fine structure in the luminescent peaks at room temperature is reported. A V-I plot shows a sublinear relation in this voltage range for several different levels of irradiation. An explanation of the observations is suggested based on self trapping of electrons. (auth)

1934

THERMOMAGNETIC GENERATOR. J. F. Elliott (General Electric Co., Syracuse, N. Y.). J. Appl. Phys. 30, 1774-7 (1959) Nov.

Calculations are made for the power output and the efficiency of energy conversion of a thermomagnetic generator. Particular attention is paid to the use of the ferromagnetic element gadolinium as a suggested material for a practical device for the generation of electrical power from a low grade heat source (i.e., in the neighborhood of 20°C). (auth)

1935

BEHAVIOR OF POLYTETRAFLUOROETHYLENE (TEFLON) UNDER HIGH PRESSURES. R. I. Beecroft and C. A. Swenson (Iowa State Univ., Ames). J. Appl. Phys. 30, 1793-8(1959) Nov.

The presence of polymorphic phase transitions, apparently unique among high polymers, enhances interest in polytetrafluoroethylene, while its potentialities for cryogenic applications make low temperature data particularly valuable. Compression measurements have been made on samples of Teflon at various temperatures between 75 and 380°K and at pressures up to 21,000 atmos. The phase diagram found for the region above the ice point is in qualitative agreement with previously published results, with a possible additional transition appearing above room temperature at pressures of over 11,000 atmos. Time effects and a large pressure hysteresis make the transition parameters quite ambiguous, and the hysteresis becomes so broad at low temperatures that the phase diagram cannot be extended below the ice point. An apparent negative thermal expansion indicated by the isothermal compression measurements is shown to result from an incomplete high pressure transition. From an engineering standpoint, the measurements indicate that a Teflon gasket loaded to 3000 atmos at room temperature should maintain a seal at any lower temperature. (auth)

1936

THERMAL CONDUCTIVITY OF EQUILIBRATED MIXTURES OF H_2, D_2, AND HD. Clarke C. Minter and Sigmund Schuldiner (Naval Research Lab., Washington, D. C.). J. Chem. Eng. Data 4, 223-6(1959) July.

The thermal conductivities for binary and ternary mixtures of H_2, D_2, and HD were determined experimentally and by calculation. Expressions which involve only the thermal conductivities of the components and their concentrations were developed for calculating the transport properties of gas mixtures. (C.J.G.)

1937

THERMODYNAMIC DATA FOR CARBON DIOXIDE AT HIGH PRESSURE AND TEMPERATURE. P. E. Liley (Imperial Coll. of Science and Tech., London). J. Chem. Eng. Data 4, 238-41(1959) July.

The enthalpy of carbon dioxide was determined at 150 to 650°C and under a pressure of 0 to 200 atm. values for the first and second virial coefficients of CO_2 at 150 to 650°C were determined at 10° intervals interpolation of the values from the work of MacCormack and Schneider (values at 50° intervals). (C.J.G.)

1938

ELASTIC STIFFNESS CONSTANTS OF CADMIUM SULFIDE. Taizō Masumi (Inst. of Physical and Chemical Research, Tokyo) and Toshio Tanaka (Univ. of Tokyo). J. Phys. Soc. Japan 14, 1313-15(1959) Oct.

The elastic stiffness constants $\|c_{ij}\|$ of wurtzite type cadmium sulfide single crystals were determined on several specimens in the form of a cube at room temperature by the ultrasonic pulse echo method at 5.0 and 10 Mc/sec. The results are as follows; $c_{11} = 0.778$, $c_{12} = 0.447$, $c_{33} = 0.881$, $c_{44} = 0.147$, and $c_{66} = 0.159$, in units of 10^{12} dynes per cm^2 by using the value of density $\rho = 4.83\ g/cm^3$. (auth)

1939

OPTICAL STUDIES ON THALLIUM-ACTIVATED ALKALI-IODIDE CRYSTALS. Yoichi Uchida and Riso Kato (Kyoto Univ.). J. Phys. Soc. Japan 14, 1408-14(1959) Oct.

Absorption and emission spectra of KI–Tl and NaI–Tl phosphors were investigated at both room and liquid air temperatures. In order to perform optical measurements on NaI–Tl, special caution was given to prevent the crystal surface from being clouded by moisture. In the absorption spectra of NaI–Tl, new bands due to the presence of thallium were found. Their maximum absorption coefficients seemed to vary with the square of the thallium concentrations. The similar fact was found by Yuster and Delbecq in their investigation on KI–Tl. In emission, both KI and NaI crystals containing high concentrations of thallium showed a subsidiary band overlapping the short wavelength tail of the hitherto observed main band. The relations between these absorption and emission bands were investigated and discussions were given in terms of an extended model proposed by Seitz. (auth)

1940

ROTATIONAL TRANSITIONS IN HYDROGEN AND DEUTERIUM. Kazuo Takayanagi (Saitama Univ., Urawa, Japan). J. Phys. Soc. Japan 14, 1458-9(1959) Oct.

The rotational transitions $0 \to 2$, $1 \to 3$, and $2 \to 4$ are given for hydrogen and deuterium at 100, 200, and 300°K. From the transitions, dispersion curves are calculated for normal deuterium and normal and para hydrogen. Hydrogen and deuterium show the dispersion in almost the same frequency region. (C.J.G.)

1941

MAGNETIC LOSSES IN CORES OF VARIOUS SHAPES. David S. Robertson (Australian National Univ., Canberra) and David Elliott (Univ. of Adelaide). Nuclear Instr. and Methods 5, 133-41(1959) Sept.

Hysteresis and eddy current losses are calculated for rectangular cores, rectangular cores with air gaps, and ring cores. The results show that a square core is only slightly inferior to an equivalent ring core. Although an air gap is shown to be of value in relieving the high concentrations of loss near the inside corners of the core, it is found to have little effect on the total loss. Similarly, the "rounding off" of inside corners is shown to be of limited value. The results of the analysis are checked experimentally. (auth)

1942

α-PARTICLES STRAGGLING IN MICA AND ALUMINUM. F. Demichelis (Istituto di Fisica Sperimentale del Politecnico, Turin). Nuovo cimento (10) 13, 562-71(1959) Aug. 1.

The straggling of α-particles in mica and aluminum is examined. For mica the experimental values agree reasonably well with the theoretical values obtained by applying the Livingston and Bethe formula; for aluminum the experimental values differ greatly from the theoretical. (auth)

1943

APPLICATION OF THE CHEW-LOW FORMALISM OF MULTI-CHANNEL REACTIONS. B. W. Lee and A. Klein (Univ. of Pennsylvania, Philadelphia). Nuovo cimento (10) 13, 891-908(1959) Sept. 1.

The Low equation for a non-relativistic scattering process was investigated, using a model in which the scattering source can exist in more than one state, and the average interaction between the source and the particle is factorable. The branching ratio theorem and the optical theorem are derived directly from the Low equation. The Low equation was solved by the method of Castellejo, Dalitz, and Dyson, and the unique solution was determined by investigating the spectrum of the unperturbed Hamiltonian. The resonance phenomena was studied and the Breit-Wigner resonance formula was derived utilizing the properties of the generalized R-function. The more general applicability of the method is indicated. (auth)

1944

FURTHER DEVELOPMENTS OF THE COVARIANT FUNCTIONAL FORMALISM FOR INTERACTING FIELDS. III. R. S. Liotta (Università, Rome and Istituto Nazionale di Fisica Nucleare, Rome). Nuovo cimento (10) 13, 921-35 (1959) Sept. 1.

The covariant functional formalism previously developed is extended to the case of coupled boson fields and of fermion fields, either free or coupled to boson fields. The sufficiency of the knowledge of the energy in order to determine the evolution of coupled fields is discussed, and some properties of the state vector, resulting immediately from the covariant functional formulation in the Schroedinger representation, are given. It is shown that at the classical limit ($\hbar \to 0$), the solution of the equations of motion for coupled fields exists and is unique. (auth)

1945

SOME REMARKS ON THE CALCULATION OF THE POLARIZATION EFFECTS. PART I. M. Carrassi and G. Passatore (Università, Genoa and Istituto Nazionale di Fisica Nucleare, Genoa). Nuovo cimento (10) 13, 944-55 (1959) Sept. 1.

Polarization effects of photons and spin-$\frac{1}{2}$ particles are expressed in a transition probability through an operator which, when applied to the polarization state of the incident beam, will give that of the scattered one. Stokes parameters are used to express the states of polarization. Calculations are given of the effects of polarization in simple Compton scattering. The rule of combination of the amplitudes and the amplitudes separately is given for the single Compton effect. A method is suggested which leads to an expression for the transition probability as a sum of terms, each describing the dependence of the cross section on the state of polarization of one or more particles. (C.J.G.)

1946

GENERALIZED STOKES PARAMETERS FOR WAVES WITH ARBITRARY FORM. P. Roman (The University

Manchester, Eng.). Nuovo cimento (10) 13, 974–82(1959) Sept. 1.

The correlation matrix of an arbitrary stationary, quasi-monochromatic electromagnetic radiation field is expanded in terms of nine linearly independent matrices and it is shown that the expansion coefficients play a role analogous to the customary Stokes parameters. (auth)

1947

GENERALIZATION OF THE LEVINSON–JAUCH THEOREM TO AN ARBITRARY NUMBER OF CHANNELS. E. Kazes (Univ. of Wisconsin, Madison). Nuovo cimento (10) 13, 983–87(1959) Sept. 1.

For a system having a finite number of channels the bound states of the free and complete Hamiltonian are shown to be simply related to the determinant and trace of the S-matrix. (auth)

1948

MUTUAL REFLECTION OF TWO SHOCK WAVES OF ARBITRARY STRENGTHS. W. R. Smith (Princeton Univ., N. J.). Phys. Fluids 2, 533–41(1959) Sept.–Oct.

Experiments were performed in air on the mutual reflection of a pair of weak shock waves of strength $\xi = 0.915$. The strengths of the shock waves were measured interferometrically. The regular reflection data agreed with the weak shock regular reflection solution for the flow. Regular reflection terminated at the extreme angle αe, and Mach reflection was found for larger angles. Four sets of experiments were performed in air with pairs of mutually reflecting shock waves of unequal strengths. The strengths of these shock waves were also measured interferometrically. The regular data agreed with the weak shock regular reflection solution for the flow. Mach reflection was found to occur for angles larger than the extreme angle. The experiments failed to resolve any of the difficulties concerned with Mach reflection. (auth)

1949

HEAD-ON COLLISION OF SPHERICAL SHOCK WAVES. I. I. Glass and L. E. Heuckroth (Univ. of Toronto). Phys. Fluids 2, 542–6(1959) Sept.–Oct.

Some experimental results are presented of colliding shock waves and the associated spherical flows generated by the blasts from two high-pressure gas spheres. Glass spheres, 2 in. in diam, with their centers located 9 in. apart, containing air or helium up to 500 psi were used to produce the explosions. Instantaneous spark shadowgrams, multi-spark schlieren photographs, and wave-speed schlieren records of the radius-time plane indicate that this method can be used successfully to study such interactions. (auth)

1950

MODEL FOR VIBRATIONAL RELAXATION OF DIATOMIC GASES BEHIND SHOCK WAVES. Robert Herman (General Motors Corp., Warren, Mich.) and Robert J. Rubin (National Bureau of Standards, Washington, D. C.). Phys. Fluids 2, 547–50(1959) Sept.–Oct.

The problem of the vibrational relaxation of a system of harmonic oscillators is examined for the case in which the oscillators are in contact with a heat bath whose total heat capacity is finite and whose temperature therefore varies during the relaxation process. An analysis is carried out for processes in which the initial distribution of vibrational energy is a Boltzmann distribution. Application is made to the vibrational relaxation of a diatomic gas behind a shock wave. (auth)

1951

ANOMALOUS PRECURSOR SIGNALS IN HELIUM SHOCKS. H. G. Voorhies and F. R. Scott (General Atomic Div., General Dynamics Corp., San Diego, Calif.). Phys. Fluids 2, 576–7(1959) Sept.–Oct.

Experimental observation of an anomalous optical precursor signal in an electromagnetically driven shock is reported. The shock tube employed is one in which a high-current conical discharge tube hydromagnetically implodes the gas at one end of a cylinder producing a hydrodynamic flow through a hollow electrode into the cylinder. The gas used was 10% helium and 90% deuterium. The velocity of the shock at the observation position was 5 cm/μ sec. The shock tube light detection system is shown. (J.E.D.)

1952

DENSITY AND EXPANSION COEFFICIENT OF LIQUID He^3 BELOW 1°K. D. M. Lee and Henry A. Fairbank (Yale Univ., New Haven). Phys. Fluids 2, 582–3(1959) Sept.–Oct.

Experimental determinations of the density and thermal expansion coefficient of liquid He^3 down to 0.14°K are presented. The ratios of the density of liquid He^3 to its maximum density as a function of the temperature at a pressure of 17 cm Hg and the thermal expansion coefficient at 17 cm Hg pressure as a function of temperature are shown. (J.R.D.)

1953

RESISTANCE MINIMUM AND RESISTIVITY OF COPPER AT LOW TEMPERATURES. S. T. Sekula (Oak Ridge National Lab., Tenn.). Phys. Rev. Letters 3, 416–18(1959) Nov. 1.

The role of the annealing atmosphere on the electrical resistivity minimum of copper was studied. The experimental techniques for these measurements are briefly described. The samples consisted of 0.05-cm diameter copper wire of 25-cm length wound around a quartz tube. The specimens were annealed in an evacuated mullite tube which allowed for annealing in desired atmospheres by means of a controlled leak. A temperature range from 1.7 to 25.0°K was covered. (W.D.M.)

1954

ABSORPTION SPECTROSCOPY OF DISPERSED SUBSTANCES. G. V. Rozenberg. Uspekhi Fiz. Nauk 69, 57–104(1959) Sept. (In Russian)

The spectroscopy of dispersed substances and problems of experimental and theoretical spectral analysis are reviewed. Optical properties of isolated particle, coherent cooperative effects, and multiple scattering are analyzed. 98 references. (R.V.J.)

1955

STRONTIUM BORATE AND STRONTIUM OXIDE MIXED PHOSPHORS ACTIVATED WITH CERIUM AND SAMARIUM. H. Witzmann and G. Herzog (Universität, Greifswald, Ger.). Z. physik. Chem. (Leipzig) 209, 179–89(1958) Aug. (In German)

The luminescent characteristics of cerium-activated strontium oxide and borate mixed crystals were studied. The cerium chloride used in the preparation of the crystals contained traces of samarium. With trivalent cerium at a concentration of 1×10^{-2} g/g of crystal, the phosphor exhibited a blue luminescence with a maximum at 460 mμ. With increasing activator concentration the spectrum is displaced toward the blue-red and finally to the red. At low activator concentration maxima attributed to Sm are detected. The effect of the strontium-oxide content of the lattice of the strontium borate crystal on the fluorescence was studied. The intensity ratios were the same for all SrO concentrations. The luminescence of cerium-activated strontium oxide and carbonate mixed crystals were also studied. (J.S.R.)

1956
EXPERIMENTAL DETERMINATION OF THE ATTENUATION COEFFICIENTS OF GAMMA RADIATION IN CYLINDRICAL EMITTERS. N. G. Smirnov and K. A. Uspenskii. Zhur. Fiz. Khim. 33, 2036-9(1959) Sept. (In Russian).

An experiment is described and the experimental values presented of attenuation coefficients in cylindrical emitters filled with cobalt solution of specific gravity 1.3 g/cm^3. The attenuation coefficients were found to be independent of the distance from the point to the emitter axis. The values for the attenuation coefficients are much greater than those for the self-adsorption coefficients obtained by Dixon for cylindrical emitters, which show that self scattering processes in emitters must be accounted for. (auth)

1957
THE ACCELERATION OF CHARGED PARTICLES BY A MOVING MAGNETIC FIELD. H. Bednarczyk (Technische Hochschule, Vienna). p. 54-61 of "IXth International Astronautical Congress, Amsterdam, 1958, Proceedings. [Vol.] I." F. Hecht, ed. Vienna, Springer-Verlag, 1959. p.1-506. (In German)

The behavior of a charged particle in a moving magnetic field is discussed. Under certain hypotheses the particle is accelerated to the field speed at the same time that a focalization of the orientation of the paths is produced. The acceleration of the particles by moving fields could be applied to laboratory studies of the effect of meteoritic showers on the shells of space vehicles. Furthermore, these experiments could inform one of the possibility of using very small particles and such particle accelerators as reaction propulsion devices, without increasing the danger of space travel. Moving magnetic field reaction propulsion could be classified, from the point of view of its operation, between thermodynamic and ionic propulsion. (auth)

1958
EXPERIMENTAL NUCLEAR PHYSICS. VOLUME III. E. Segrè, ed. New York, John Wiley and Sons, Inc., 1959. 819p.

The subject is limited to nuclear physics in the strict sense; that is, mesons and other subjects concerning subnuclear particles, which, in general, are studied experimentally at energies of hundreds of Mev, are omitted. The book, volume III of three volumes, is intended for the advanced student and the research worker. Subjects treated include radioactive decay, alpha radioactivity, gamma rays, beta rays, and particle accelerators. (W.D.M.)

Astrophysics and Cosmology

1959
THE STEADY-STATE UNIVERSE AND THE DEDUCTION OF CONTINUAL CREATION OF MATTER. V. A. Bailey (Univ. of Sydney). Nature 184, Suppl. No. 8, 537(1959) Aug. 15.

The idea of continual creation of matter out of nothing is equated of a five-dimensional universe. (T.R.H.)

1960
ARTIFICIAL NUCLEAR ENERGY SOURCES IN COSMIC SPACE. O. S. Wołczek (Institut für Kernphysikalische Forschungen, Warsaw). p. 67-87 of "IXth International Astronautical Congress, Amsterdam, 1958, Proceedings. [Vol.] I." F. Hecht, ed. Vienna, Springer-Verlag, 1959. p.1-506. (In German)

The question of the exploitation of nuclear energy for experimental purposes in cosmic space is treated. Artificial sources of this energy—explosive and non-explosive—could serve studies concerning cosmic space proper by determining the matter present in it and by permitting the exploration of the properties of this matter. The mentioned sources would further permit a more definite exploration of such structures as meteoritic swarms. It is proposed that special cosmic laboratories should be formed in which research in the field of experimental astrophysics on star models could be carried out with respect to artificial sources of nuclear energy. This kind of laboratory would be devoted to the study of variegated problems, beginning with practical exploitation of nuclear energy for the generation of electric energy on the Earth surface and extending up to to the problem on the occurrence of so-called anti-matter and its properties. (auth)

Cosmic Radiation

1961 SUI-59-23
Iowa. State Univ., Iowa City.
OBSERVATIONS PERTAINING TO COSMIC RAY ORIGIN. Kinsey A. Anderson. [1959]. 19p.

Assuming the other stars in the galaxy supply energetic particles in the same manner as the sun, the high-energy cosmic radiation might be maintained if the Fermi acceleration process provided a high rate of energy gain per gas cloud collision. However, calculations show that a high rate of energy gain does not lead to the flat energy spectrum exhibited by the galactic cosmic rays. Also, the absence of fast solar-accelerated helium indicates that if the sun is to be a typical injector of cosmic radiation the energy gain in the galaxy would have to be rapid, a requirement again inconsistent with the spectral shape calculation. It therefore appears that using the sun as a model cosmic ray injector together with the Fermi acceleration process is not a suitable means of producing the galactic cosmic radiation. (auth)

1962
THE GENERATION OF QUICK DEITRONS IN LEAD AND COPPER BY THE NUCLEON COMPONENT OF THE COSMIC RADIATION. G. V. Badalyan. Izvest Akad. Nauk Armyan. S.S.R., Fiz. Mat., Estestven. i Tekh. Nauki 11, No. 6, 3-14(1958).

A magnetic spectrometer with two Wilson cameras is used for the separation of the air deuterons from the deuterons locally generated in the upper chamber by the nuclear-active component of cosmic radiation. 68 of the 104 registered deuterons are generated in the lead and 36 in the copper of the chamber walls. The effectiveness of deuteron generation by neutral and charged components of the cosmic radiation, the impulse spectrum of the deuteron generation, the estimation of the deuteron differential cross section of generation in the medium of the upper chamber, and the possible theoretical proof of the observed results are discussed. (TCO)

1963
THE INFLUENCE OF MODULATION EFFECTS ON SOLAR FLARE RADIATION. Robert R. Brown (Univ. of California, Berkeley). J. Geomagnet. Geoelec. 10, 1-6(1958).

The modulation of cosmic rays at the time of the February 23, 1956 solar flare cosmic ray outburst was estimated from the latitude variation of the cosmic ray intensity decrease observed in the period surrounding the flare event. The perturbing influence of these modulation effects on the rigidity spectrum of the flare radiation was calculated. The change in the slope of the rigidity spectrum is found to be small as the modulation function does not have a strong dependence on rigidity between low and middle magnetic latitudes. (auth)

1964

LATITUDE VARIATION OF COSMIC RAY INTENSITY DECREASES AT SEA-LEVEL. Robert R. Brown (Univ. of California, Berkeley). J. Geomagnet. Geoelec. 10, 64-5(1959)

Following a procedure used previously in a mountain altitude calculation, a yield function was combined with the modulation function and primary spectra to obtain the latitude variation of intensity decreases at sea level. Results of the calculations are shown to be in reasonable agreement with experimental data. (W.D.M.)

1965

EVIDENCE FOR COSMIC RAY ENERGY SPECTRUM CHANGES DURING A FORBUSH DECREASE. K. W. Ogilvie and M. M. Winn (Univ. of Sydney). Nature 184, Suppl. 12, 888-9(1959) Sept. 19.

An analysis of the multiplicity of neutron production during the May 1959 Forbush decrease is given. It is concluded that the mechanism of multiplicity decrease was such that the rate was lowered by removing particles from the low-energy end of the cosmic-ray spectrum. (C.J.G.)

1966

FURTHER INVESTIGATION OF A HIGH ENERGY JET. G. Bozoki, G. Domokos, E. Fenyves, A. Frenkel, and E. Gombosi (Central Research Inst. of Physics, Budapest) and D. Bebel, K. Lanius, and H. W. Meier (Deutsche Akademie der Wissenschaften, Berlin and Kernphysikalisches Institut, Zeuthen, Ger.). Nuovo cimento (10) 13, 662-4(1959) Aug. 1.

The energies of secondary particles were determined by relative and single scattering measurements and by analysis of the secondary electron-photon cascades. It is shown that in high energy jets, in general only the order of magnitude of primary and secondary energies, transversal momenta and inelastic coefficients can be determined. (C.J.G.)

1967

THE RELATION BETWEEN COSMIC-RAY INTENSITY AND GEOMAGNETIC ACTIVITY DURING PERIODS OF HIGH AND LOW SOLAR ACTIVITY. R. Van Der Walt (South African Atomic Energy Board, Pretoria). Nuovo cimento (10) 13, 936-43(1959) Sept. 1.

The phase relationships between variations in cosmic-ray intensity and geomagnetic activity were studied for the period June, 1957, to August, 1958. The results indicate a definite difference in the relationship for periods of high and of low solar activity. It is suggested that this difference may be due to the more frequent occurrence of severe Forbush decreases during periods of maximum solar activity. (auth)

1968

ELECTROMAGNETIC PROCESSES AT HIGH ENERGIES. PART I. ANOMALOUS SHOWERS. P. K. Aditya (Panjab Univ., Chandigarh, India). Nuovo cimento (10) 13, 1013-25 (1959) Sept. 1.

The problem of anamalous showers is discussed to compare their fluctuations with those for two other samples of electromagnetic cascades. It was concluded that the observed discrepancies are a result of the individuality of the events and that the fluctuations are similar to those for normal cascades. In general the fluctuations are found to be not very much larger than those for a Poisson distribution. (auth)

1969

THE COSMIC RAY STORM OF MAY 11, 1959. F. Bachelet, P. Balata, A. M. Conforto, N. Iucci, and G. Marini (Università, Rome; Istituto Nazionale di Fisica Nucleare, Rome; and Commissione Italiana Anno Geofisico Internazionale, Rome). Nuovo cimento (10) 13, 1055-9(1959) Sept. 1.

A discussion is given on the observed sudden decrease of the cosmic-ray intensity in Rome on the night of May 11, 1959, in connection with the sudden commencement of a geomagnetic storm. (C.J.G.)

1970

THE APPARENT SIDEREAL DAILY VARIATION OF COSMIC RAY INTENSITY DURING THE RECENT SUNSPOT MINIMUM. S. P. Baliga and T. Thambyahpillai (Univ. of Ceylon, Colombo). Phil. Mag. (8) 4, 973-84(1959) Aug.

The unusually large changes of phase which occurred in the cosmic ray solar daily variation during the year 1954 were found by Conforto and Simpson to simulate strong sidereal daily variations. These authors suggested that their results represent a genuine sidereal effect which is observable only during periods of extremely low solar activity, as in 1954. A systematic search for sidereal effects during this year was made using the results from the Carnegie Institution stations as well as Colombo, Hobart, and Tokyo. Although no significant sidereal effects were seen at Colombo, the other data show substantial sidereal daily variations with a remarkable consistency in phase. The time of maximum at the equator was 19 hr L.Sid.T. while at higher latitudes it was about 22 hr L.Sid.T. The character of the solar diurnal variations and the relations between their seasonal changes and sidereal daily variations are discussed and it is concluded that at least a part of the observed sidereal effects were spurious. (auth)

1971

LIFETIMES OF TRAPPED RADIATION BELT PARTICLES DETERMINED BY COULOMB SCATTERING. R. C. Wentworth, W. M. MacDonald, and S. F. Singer (Univ. of Maryland, College Park). Phys. Fluids 2, 499-509(1959) Sept.-Oct.

Once introduced into captive orbits, protons and electrons should be strictly trapped in the earth's dipole magnetic field. However, various mechanisms exist which limit their lifetimes, such as collisions with atoms and ions in the earth's outer atmosphere, charge exchange, and scattering by hydromagnetic waves. This paper considers only the effect of the scattering of these particles by the ionized hydrogen and electron components of the outer atmosphere. However, the effect of scattering from neutral atoms can be qualitatively taken into account by using the radius of the atom in place of the Debye shielding length in the scattering formulas. The Fokker-Planck equation has been used to derive an expression for the change in the distribution function due to small-angle, single-particle Coulomb collisions. Upper lifetime limits, as determined by this mechanism, of both protons and electrons are derived as functions of their initial energies. (auth)

1972

INDICATIONS FOR INCREASED COSMIC RADIATION IN THE INTERPLANETARY SPACE. A. Ehmert (Max-Planck-Inst. for Aeronomy; Lindau, Ger.). p. 639-43 of "IXth International Astronautical Congress, Amsterdam, 1958, Proceedings. [Vol.] II." F. Hecht, ed. Vienna, Springer-Verlag, 1959. p.507-970.

A simple connection was experimentally found between the amplitudes of world-wide variations of cosmic-ray intensity and the dependence of this intensity on geomagnetic latitude. It turns out that these variations can be interpreted as changes of an electric potential of the Earth against the deep space. The sun's activity seems to govern this potential. An independent indication for this arises from the difference in the energy spectra of primary protons and α-particles. In undisturbed regions a higher and possibly dangerous cosmic ray intensity is expected, but these regions may be at the boundaries of the planetary system. Attention is called to the high intensities that occur after the rare outbursts of solar cosmic rays and to particles trapped in the earth's magnetic field. (auth)

Criticality Studies

1973 ANP-66
Oak Ridge National Lab., Y-12 Area, Tenn.
SOME RESULTS OF CRITICALITY CALCULATIONS ON BeO AND Be MODERATED REACTORS. J. W. Webster and O. A. Schulze. Oct. 15, 1951. Decl. Oct. 9, 1959. 98p. Contract W-7405-eng-26. OTS.

Results of criticality calculations are given for an intermediate energy BeO moderated reactor of 2.69-ft core diameter and for numerous variations of its parameters. The subjects quantitatively studied are: effect of core composition and core size, effect of xenon and uranium lumping, effect of reflector, and effect of iteration of the source term. Graphs are given for normalized fissioning spectrum, spatial power distribution, and leakage spectrum on each reactor assembly where significant. Also included is a graph showing the effect of reflector thickness on reactivity and a graph showing the convergence of the fission distribution with its iteration as the source distribution. The method of calculation is a 31-group numerical multigroup technique essentially that used by KAPL with modifications to adapt it to IBM computation. (auth)

1974 MND-E-2132
Martin Co. Nuclear Div., Baltimore.
CORE EXTRAPOLATION EXPERIMENTS—ERDL TASK 103, PHASE 3. Sept. 1959. 46p.

Critical experiments were performed on a stainless steel-water core in support of the ANPP Code Development Program. The cold, clean, critical mass was determined experimentally to be 15,700 ± 10 gm of U^{235}. The core configuration was a 4 × 4 array containing 2 safety control rods and 14 stationary elements, 1 of which contained a CE control rod. The analytically determined reactivity of the experimentally just-critical core was calculated twice using two independently and chemically determined values of the weight percentage of boron in the boron-stainless steel plates used in the experiment. The reactivity calculated, using one of these values, agreed with the experimental value within 0.5% ΔK/K. A third independent chemical analysis will determine if this value is correct. A power calibration was made using aluminum catcher foils and fuel plate scanning techniques. The calculated power for the two determinations was 1.8 and 11.3 w. The CE control rods were calibrated using period measurements and subcritical multiplication techniques. The total worth of the CE system was found to be 1.112% ΔK/K. The fuel worth was determined in four fuel elements and was found to vary from 0.00066 to 0.00292% ΔK/K per gram of U^{235}. The boron worth was measured in the same elements as the fuel worth experiments. The values varied from −0.053 to −0.22% ΔK/K per gram of boron. The temperature coefficient was determined over the range 20 to 70°C. The coefficient was found to be -7×10^{-5} ΔK/K at 35°C. The accuracy of the calculated temperature coefficient as a function of temperature and material worth was not sufficiently satisfactory and must be improved. The reactivity worth of the safety follower box was compared to that of a stationary box and was found to be −0.048% ΔK/K. The effect of Cd in the reflector region was measured by adding Cd-Sn alloy to one face of the reactor and measuring the change in reactivity. Twelve strips of 2% Cd were equivalent to −1.08% ΔK/K. The reproducibility of the control rod positions at criticality was noted. The average difference in reactivities between runs on the same configuration was less than 1%. (auth)

1975 NAA-SR-Memo-913(Rev.II)(Del.)
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
FLAT FLUX CORES. R. Balent. June 11, 1954. Decl. with deletions Oct. 22, 1959. 15p. OTS.

A convenient method by which the critical size, mass, and fuel distribution function can be calculated for the case of flat thermal flux across the core is outlined using simple diffusion theory. It is shown that the criticality condition for flat thermal flux using two neutron energy groups over two regions is given by a transcendental equation, which is fully as convenient to solve as is ordinary two group theory. A few calculations using the theory were made with different reflector thicknesses. The results are given and compared to the results obtained from ordinary two group theory. The critical radius as a function of reflector thickness for the flat flux case exhibits an unusual characteristic in that the core radius decreases with decreasing reflector thickness to a minimum value at some intermediate reflector thickness and then increases. A discussion of the possible advantages which flat flux cores would have, some of the limitations and a few examples as to how the fuel distribution could be obtained in various core designs is given. (auth)

1976 NAA-SR-Memo-3854
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
SRE CRITICALITY FOR URANIUM-CARBIDE FUEL. F. L. Fillmore. May 13, 1959. 5p. OTS.

The critical mass for the third SRE fuel loading using 5.85% enriched uranium carbide fuel in a 7 rod cluster 5.5 ft long was calculated for a wet (180°C) clean, hot (425°C) clean, and hot (425°C) poisoned cores. An excess reactivity of 3.5% above hot-poisoned was provided for. A reactor power of 20 Mw and UC density of 13.63 g/cm^3 were assumed. (W.D.M.)

1977
MIGRATION AREAS AND EFFECTIVE DELAYED NEUTRON FRACTIONS BY CRITICAL EXPERIMENTS. G. A. Price (Brookhaven National Lab., Upton, N. Y.). Reactor Sci. 10, 111-15(1959) Sept.

Migration areas and effective delayed neutron fractions were measured in critical assemblies of slightly enriched uranium rods in light water. The fuel consists of uranium rods enriched to 1.3 per cent U^{235}, 4 ft long, 0.387 in diameter and aluminum clad. Water to uranium volume ratios of 2 : 1, 3 : 1, and 4 : 1 were investigated. Migration areas were measured by observing the effect of fuel rod changes and boron poison in the water, separately and combined, on the excess reactivity. The analysis yields a value of M^2 which depends on the delayed neutron parameters, and one which is independent of them. Values of M^2 obtained by these methods are compared with those obtained earlier by sub-critical methods. A value of the effective delayed neutron fraction, $\gamma\beta$, in these assemblies is derived from the effect of uniform boron poison on the reactor periods. An average value of 0.0069 ± 0.0001 is obtained for the three assemblies. (auth)

Elementary Particles

1978 IFA/FT/32

Academia R. P. R. Institutul de Fizica Atomica, Bucharest.

CONSIDERATIONS THEORIQUES SUR LA DESINTEGRATION $\pi \rightarrow \mu$. (Theoretical Considerations on the Disintegration $\pi \rightarrow \mu$). Serban Tiţeica. 1959. 23p.

Recent experimental data indicate that the angular distribution of muons from pion decay is not isotropic. The implications of this data would contradict the commonly accepted hypothesis according to which the pion has zero spin. The angular distribution of muons is treated theoretically for the case of non-zero spin of the pion. The calculations are made under the assumption that the pion has an unknown but fixed spin and an arbitrary polarization state. It disintegrates into two fermions with spin $\frac{1}{2}$ and the disintegration occurs at rest. The laws of conservation of energy, momentum, and kinetic moment are valid. It is assumed that after the disintegration the fermions will have an energy equal to the rest energy of the pion, a total momentum of zero, and a kinetic energy equal to that of the pion. The neutrino mass is zero, but no assumption is made with respect to parity conservation nor to the validity of the two-component neutrino theory. (J.S.R.)

1979 JEN-39

Spain. Junta de Energia Nuclear, Madrid.

FISICA DEL NEUTRON. (Neutron Physics). Carlos Sanchez del Rio, M. Aranzazu Vigon, Francisco Verdaguer, Eduardo Rodriguez Mayquez, and Julio Montes. 1958. 237p.

Neutron physics is discussed in terms of the neutron and its interactions, neutron production, neutron detection, scattering of thermal neutrons, moderation of neutrons, and chain reactions maintained with neutrons. (J.S.R.)

1980 UCRL-8858

California. Univ., Berkeley. Lawrence Radiation Lab.

INVERSION OF THE ANGULAR-MOMENTUM EXPANSION OF MESON PHOTOPRODUCTION AMPLITUDES. James S. Ball. Aug. 18, 1959. 10p. Contract W-7405-eng-48. OTS.

Helicity amplitudes are written for photoproduction of mesons and related to the amplitudes of Chew, Goldberger, Low, and Nambu. The expansions of both types of amplitudes in terms of amplitudes for particular angular-momentum states are then inverted. (auth)

1981 UCRL-8888

California. Univ., Berkeley. Lawrence Radiation Lab.

S-WAVE $\overline{K}$-N SCATTERING AMPLITUDES. Ulrich Kruse and Michael Nauenberg. Sept. 11, 1959. 13p. Contract W-7405-eng-48. OTS.

A simple graphical method is described to obtain the S-Wave $\overline{K}$-N scattering amplitudes from experiment, and apply it to the most recent hydrogen bubble chamber data at 172 Mev/c K laboratory momentum. Because the cross-sections for production of neutral hyperons are still undetermined at this energy the results are expressed as a function of the ratios $r_1 = [\sigma(\Sigma^0 + \lambda)/\sigma(\Sigma^+ + \Sigma^-)]$ and $r_2 = [\sigma(\Sigma^0)/\sigma(\Sigma^0 + \lambda)]$. Some comments on the zero effective range approximation are also included. (auth)

1982

ON THE FERMI ZERO-POINT KINETIC ENERGY OF PARTICLES WITH SPIN $\frac{1}{2}$. P. Szepfalusy. Acta Phys. Acad. Sci. Hung. 7, 433-46(1957). (Translated from Referat. Zhur. Fiz. No. 5, 1959, Abstract No. 10292).

In a statistical calculation of the kinetic energy of particles with half-integral spin, the summation over the states of the particles by integration is usually replaced. However, under certain supplementary assumptions, this summation can be performed accurately. The unidimensional and radially-symmetrical problems in the grouping of electrons by orbital quantum numbers, and the general three-dimensional case are considered. The facts are taken into account that the number of phase cells is not always equal to half the number of particles (unidimensional case) and that the highest-energy shell is not always filled with particles (three-dimensional case). The summation over quantum states of the individual particles thus becomes accurate. The value obtained for the kinetic energy of the particle system differs from the preceding coefficient, which depends on the number of particles and on their quantum state. Tables are compiled for this coefficient.

1983

A COMPARISON OF THE CHARGES OF THE ELECTRON, PROTON AND NEUTRON. A. M. Hillas and T. E. Cranshaw (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Nature 184, Suppl. 12, 892-3(1959) Sept. 19.

Experiments were conducted to determine the neutron and hydrogen atom charges. A method for detecting a charge on a large volume of de-ionized gas by observing a change of potential of a vessel from which the gas was allowed to escape was applied to argon and nitrogen. The neutron charge was found to be $(-1 \pm 3) \times 10^{-20}$e and the hydrogen-atom, $(1 \pm 3) \times 10^{-20}$e. (C.J.G.)

1984

DECAY OF A TAU-MESON UNDERGROUND. A. M. Short (Coll. of Advanced Tech., Birmingham, Eng.). Nature 184, Suppl. 12, 893-4(1959) Sept. 19.

A τ-meson decay was found in Ilford G-5 emulsions of 400 μ thickness at a depth of 57 mwe underground. The τ-meson entered the stack at an angle of 60° and stopped after covering a range of 4.7 mm which indicates a kinetic energy on entry of 25.9 ± 0.3 Mev. The τ-meson was found among 134 μ-mesons, 97 p-mesons, 17 σ-mesons, 5 π^+-mesons, 10 neutron stars, and 9 stars with charged primaries, in a scan covering 38 cc of emulsion. (C.J.G.)

1985

A CHECK OF DISPERSION RELATIONS FOR PHOTOPRODUCTION OF π-MESONS. A. M. Baldin and B. B. Govorkov (Lebedev Physical Inst., Moscow). Nuclear Phys. 13, 193-203(1959) Oct. (1).

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 21401.

1986

INTENSITY DISTRIBUTION OF HIGH ENERGY PIONS IN THE ATMOSPHERE. A. Subramanian and S. D. Verma (Tata Inst. of Fundamental Research, Bombay). Nuovo cimento (10) 13, 572-90(1959) Aug. 1.

The vertical intensity distribution of pions in the atmosphere, in the energy range 10^{10} to 10^{12} ev, is calculated from the energy spectrum of muons at sea level. It is found that, at all depths in the atmosphere, pions should account for only a minor fraction of the intensity of nuclear active particles in the above energy range. A comparison of the energy spectrum of pions at production with the primary nucleonic spectrum leads to the result that the average inelasticity in collisions of nucleons with air nuclei, in the energy range 10^{11} to 10^{13} ev, lies between 0.5 and 0.3, if reasonable limits to the multiplicity of mesons produced in such collisions are set. It is pointed out that the generation of pions by pions in the atmosphere may have appreciable effect in the zenith angular dependence of muons underground, and if so, this leads to the result that pions are more efficient in producing pions than nucleons, in collisions with air nuclei. (auth)

1987

GAUGE INVARIANCE OF BARYON EQUATION. C. Ceolin and T. Toyoda (Università, Padua and Istituto Nazionale di Fisica Nucleare, Padua). Nuovo cimento (10) 13, 605-13 (1959) Aug. 1.

A nonlocal, but microcausal, interaction is written between the pseudoscalar pionic field and the baryonic field (η-Ξ). This interaction is obtained by the elimination of a field Φ_μ (associated to each spinor field by the requirement that the theory be not only Lorentz covariant but affine covariant) through which the π-meson is coupled to the baryons (η-Ξ). (auth)

1988

K^-, $\bar{K}^0$ RELATIVE PARITY AND THE K^--d CHARGE EXCHANGE REACTION. T. B. Day, G. A. Snow, and J. Sucher (Univ. of Maryland, College Park). Nuovo cimento (10) 13, 614-27(1959) Aug. 1.

The reaction $K^- + d \rightarrow \bar{K}^0 + 2n$ is studied in the hope that limitations on the final states for the two neutrons due to statistics will help differentiate between even and odd relative parity of the K^- and $\bar{K}^0$ mesons. The total cross-section for the reaction is calculated in the impulse approximation, and expressed in terms of the corresponding hydrogen cross-section for both even and odd parity. The calculations are carried out with the use of antisymmetrized plane waves for the two neutrons, and in the closure approximation. The ratio of the odd to even parity cross sections is about a factor of two in either approximation. The total cross-section for odd parity in the plane wave approximation is found to be about 4 mb at a K^- laboratory momentum of 136 Mev/c. (auth)

1989

RELATIVISTIC PARTICLE WITH INTERNAL ROTATIONAL STRUCTURE. T. Takabayasi (Institut Henri Poincaré, Paris). Nuovo cimento (10) 13, 532-54(1959) Aug. 1.

General kinematical and dynamical aspects of any covariant theory of particles possessing internal angular velocity together with internal angular momentum are analyzed. Theory is classified according to the form of subsidiary conditions required. A precise theory is constructed by the aid of a spinor ξ as the kinematical representation of such structure, postulated in an equation of motion. The equation contains a self-interaction term of the third order, and thus the theory may be considered to represent the particle analogue to the non-linear field of Heisenberg. Still it can be solved exactly, the result showing that the particle performs, besides its mean rectilinear motion represented by the constant momentum vector p_μ, an orbital zitterbewegung around it, and the synchronized precession of the internal third axis around the constant helicity pseudovector. The theory of Weyssenhoff is included in the present theory as a degenerate case in which the internal angular velocity becomes physically arbitrary. It is expected that a unified model of elementary particles may be reached by quantization starting from this generalized classical model. (auth)

1990

ENERGY LOSS OF ELECTRONS PASSING THROUGH A GRAPHITE SINGLE CRYSTAL AT DIFFERENT INCIDENT ANGLES. Hiroshi Watanabe (Hitachi Central Research Lab., Tokyo). J. Phys. Soc. Japan 14, 1453(1959) Oct.

The energy loss of 25 kev electrons when passed through a thin film of single graphite crystals at 0 and 45° was determined to be 6.8 ± 0.2 ev at both angles. The result shows that the loss value does not depend on the incident angle Θ. The resonant energy between nearest neighbors in a lattice layer was estimated to be 1.6 ev. (C.J.G.)

1991

CHARGES. Pierre Renson (Université, Liège, Belgium). Physica 25, 809-24(1959) Sept.

Properties of charges in general are discussed and it is shown that, whatever the nature of the charge considered, its value for any elementary particle can be deduced from the corresponding values for a minimum number of such particles, namely 3. This leads to the introduction of a "charge-space" which, in the present state of knowledge, is three-dimensional. The "neutrinonic charge" which is to the neutrino what the electric charge is to the electron is especially studied. Correlations between charges and S and T_3 are discussed. (auth)

1992

LIQUID DYNAMICS AND INELASTIC SCATTERING OF NEUTRONS. P. G. De Gennes (Centre d'Etudes Nucléaires, Saclay, France). Physica 25, 825-39(1959) Sept.

The energy transfers in one collision between a neutron and a liquid are computed by a method of moments. It is shown that for large momentum transfers a perfect gas model is correct. For small momentum transfers a macroscopic description of the density fluctuations in the liquid is applicable. It is in the intermediate region (where diffraction peaks are observed) that the method of moments is most useful. These different experimental situations are discussed for liquids where recoil and quantum effects are negligible, and numerical results are given for argon. An approximation for the so-called autocorrelation function, valid for both long and short time scales and all distances, is also presented. (auth)

1993

ON THE ABSORPTIVE RANGE IN THE PION-NUCLEON COLLISION AT HIGH ENERGIES. Kin-ichi Ishida (Yamagata Univ., Japan). Progr. Theoret. Phys. (Kyoto) 21, 676-80(1959) May.

The absorptive range in the pion-nucleon collision at high energies with an additional pion production is investigated on the standpoint of the π-π interaction model. For this purpose, the "root mean square of the impact parameter" $(\overline{b^2})^{1/2}$ is introduced and is calculated under the local $\pi-\pi$ interaction and some assumptions. The $(\overline{b^2})^{1/2}$ thus obtained is somewhat smaller compared with the experimentally inferred one. (auth)

1994

KINEMATICS AND THE NEUTRON-DEUTERON SCATTERING. Tetsuo Hamada (Univ. of Sydney). Progr. Theoret. Phys. (Kyoto) 21, 769-78(1959) June.

The kinematics of the elastic neutron-deuteron scattering is studied taking into account the possible spin-orbit coupling in the scattering interaction. The investigation covers the general structure and the parametrization of the scattering matrix, the differential cross section and the polarization, and the behavior of those parameters characterizing the scattering matrix near zero energy. A rigorous and explicit basis for the phase shift analysis of the elastic neutron-deuteron scattering is given. (auth)

1995

MESON DECAYS AND STRUCTURE OF MUON. Mituo Taketani, Yasuhisa Katayama, Paulo Leal Ferreira, Gerhard Wilhelm Bund, and Paulo Roberto de Paula e Silva (Instituto de Física Teórica, São Paulo, Brazil). Progr. Theoret. Phys. (Kyoto) 21, 799-817(1959) June.

Considering the peculiar position of the muon among the elementary particles, it seems reasonable to assume an inner structure for this particle. The analyses proposed are mainly connected to pion and muon decay problems. Assuming the so-called universal Fermi interaction, with V and A couplings, by which the decay processes are realized, the considerations are restricted to the behaviors of the non-local form factor which arise from the muon structure. Also possibilities of the electron structure are discussed. The analysis depends on the deviation of the asymmetry parameter. Its deviations from the original local value must be within about 6%, and a value larger than this cannot be explained without consideration of the electron structure and some other sources. (auth)

1996
ON THE ORIGIN OF THE ELECTRON MASS. Yashisa Katayama, Mituo Taketani, and Jorge Leal Ferreira (Instituto de Física Teórica, São Paulo, Brazil). Progr. Theoret. Phys. (Kyoto) 21, 818-26(1959) June.

Some possibilities for understanding the dynamical origin of the electron mass are examined. As the present formulation of quantum electrodynamics does not give, within its region of validity, a satisfactory answer to this problem, two possibilities for obtaining the electron mass, starting from a zero bare mass, are presented. The first one is a nonlocal modification of quantum electrodynamics, which may be closely related to the electron structure. The other is to get the electron mass from the masses of other elementary particles through weak interactions, because at the high energy region discussed, the weak interactions become more predominant compared to the electromagnetic interaction. These possibilities can be examined by improvements in experiments. The former depends on the experimental accuracies of the electron moment, and the latter is related to the degree of coexistence of S, P, and T couplings in coexistence with the main V and A couplings in β decays and/or to the degree of the deviation from the V-A combination in the muon-electron interaction. (auth)

1997
THE PION-NUCLEON DISPERSION RELATION AND SMALL P-WAVE PHASE SHIFTS. Akira Kanazawa, Tetsuro Sakuma, and Shinya Furui (Hokkaido Univ., Sapporo, Japan). Progr. Theoret. Phys. (Kyoto) 21, 856-66(1959) June.

The behavior of the small p-wave phase shifts are investigated, with use of the integrated forms of the G.M.O. dispersion relations, which are free from the ambiguity due to the principal integral of the total cross sections but are sensitive to the real part of the amplitude at low energies (<100 Mev). For the (3/2,3/2) amplitude the result from Puppi's analysis is used besides the experimental data, which greatly reduces the ambiguity due to the lack of precise experimental knowledge on the (3/2, 3/2) phase shift at very low energies. It is shown that Lomon-Chiu's data on the small p-wave phase shifts are definitely in contradiction with the dispersion relation for the isospin even amplitude. This conclusion is not altered even if every one of the small p-wave phase shifts is varied by 100%. The disparity is removed, however, if one uses rather large negative δ_{13} at low energies (<100 Mev). On the other hand, for the isospin odd amplitude, there is no such disparity irrespective of such alternative choices of the small p-wave phase shifts with the coupling constant of $0.07 \sim 0.10$. (auth)

1998
CHARACTERIZATION OF (Y,Z)- AND (Λ,Σ)-MODES. Takao Okabayashi (Univ. of Tokyo). Progr. Theoret. Phys. (Kyoto) 21, 867-78(1959) June.

New assignment of isotopic spin and the concepts of K-meson charge and of K-meson charge conjugation are introduced in order to characterize (Y,Z) and (Λ,Σ) modes. If the selection rule $|\Delta I| = \frac{1}{2}$ is assumed for weak interactions, suitable combinations of them can be expressed in terms of (Y,Z) mode, and they are invariant under K-meson charge conjugation, and under the rotation in isotopic spin space, owing to the new assignment of isotopic spin. Then in decay processes neutral K mesons appear always in (K_1^0,K_2^0) mode. Strong interactions are naturally invariant under the rotation. Therefore the newly assigned isotopic spin can be treated as an absolutely conserved quantity in an approximation. Thus, some close correlation between the three selection rules about hyperonic charge, isotopic spin, and space parity, which characterize the strength of interactions, is achieved. (auth)

1999
SETTING UP AN S-MATRIX FOR DRESSED PARTICLES. Yu. V. Novozhilov. Vestnik Leningrad. Univ., Ser. Fiz. i Khim. No. 2, 5-13(1959).

An S-matrix for dressed particles is set up on the basis of Hamilton's formulas but without the use of the hypothesis on the adiabatic introduction of the field interaction. Thus, this is the problem of setting up a function for noninteracting dressed particles. The wave function of the noninteracting dressed particles Ψ_n^0 can be interpreted in the form of the derivations of the generating operators of the physical particles λ_N^+, $\lambda_{\bar{N}}^+$, λ_π^+, λ_B^+, applied to the physical vacuum Ψ_0. The permutation relations of the operators λ^+ with the absorption operators λ have a general form. In general, the state of the noninteracting particles can be set up by means of the operators of the physical particles. In the theory of dressed particles, however, the existence of an equation of motion for the field operators which is otherwise missing for noninteracting particles is presupposed. A simplified case is assumed where for the calculation of the S-matrix Ψ_n^0 need not be known and simpler functions $\Phi(t)$ with the same asymptotic behavior as $\Psi(t)$, Ψ_n^0 are sufficient. (TCO)

2000
THE THEORY OF ELEMENTARY PARTICLES. J. Hamilton. Oxford, Clarendon Press, 1959. 491p.

The object of the book is to give an account of the more important theoretical methods which are used in describing the properties of the elementary particles, and in explaining their observed interactions. A familiarity with the simpler phenomena of elementary particle physics was necessarily assumed in the reader; however, when discussing recent experiments or less well-known phenomena, references to the experimental material are given. (W.D.M.)

Nuclear Properties and Reactions

2001 AECU-4437
Johns Hopkins Univ., Baltimore.
ANNUAL REPORT. PART A: STUDIES IN K-CAPTURE POSITRON BRANCHING RATIOS. PART B: SEARCH FOR A LOW-LYING O^+ STATE IN GALLIUM-68. L. Madansky and M. Ramaswamy. Aug. 1959. 63p. Contract AT(30-1)-2028. OTS.

K-capture to positron branching ratios were measured in the decay of Na^{22}, Co^{58}, and Ga^{68}—all pure Gamow-Teller emitters, using coincidence scintillation spectrometer techniques. The measured values are 0.105 ± 0.004 for Na^{22}, 5.08 ± 0.17 for Co^{58}, and 1.28 ± 0.12 and 0.10 ± 0.02

for Ga^{68}. From these the Fierz interference term is computed to be b = −0.004 ± 0.012, −0.004 ± 0.14, −0.03 ± 0.02, and +0.03 ± 0.01, respectively. These results indicate that the Fierz interference in Gamow-Teller interaction is very small. The decay of 270 day Ge^{68} was investigated in equilibrium with Ga^{68} to look for a possible low-lying O^+ level in Ga^{68} using x-ray–x-ray and x-ray–γ-ray coincidences. The result was negative. Besides the 9 kev K x ray, the 1.07 Mev gamma ray in the decay of Ga^{68} and annihilation radiation, no other gamma rays were detected (<8% of 1.07 Mev gamma ray). The number of positrons per 1.07 Mev γ-quantum was determined as 19.47 ± 2.10. The ratio of positrons to the 1.07 Mev level and ground state of Zn^{68} was found to be $(1.76 \pm 0.22) \times 10^{-2}$. Studies with a Ge^{68} source chemically separated from Ga^{68} showed no gamma rays (<1% of total Ge^{68} decays). By following the growth of annihilation radiation, an upper limit of 0.4% per decay could be set on the amount of positron emission by Ge^{68}. A search for an electric monopole (EO) transition from the 2.3 Mev level to the O^+ ground state of Zn^{68} was made using plastic scintillators and an anti-coincidence arrangement. An upper limit of $(5 \pm 25) \times 10^{-9}$ conversion electrons per decay of Ga^{68} could be set. This is interpreted as evidence against a possible O^+ spin assignment for the 2.3 Mev level, but the interpretation is not conclusive. A brief review is presented regarding the status of Fierz interference in beta-decay as revealed by present studies and other experiments. (auth)

2002 JEN-13
Spain. Junta de Energia Nuclear, Madrid.
SELBSTABSORPTION DER ZERFALLSELEKTRONEN VON In^{116} IN INDIUMMETALL. (Self-Absorption of the Decay Electron of In^{116} in Indium Metal). M. A. Vigon and E. Montero. 1956. 4p.

Indium foils are often used for measurements of neutron fields by detection of the decay electron from In^{116}. The absorption of this electron by the indium metal therefore affects the activity measured. In^{116} also emits gamma radiation with energies between 0.1 and 2.32 Mev. The absorption constants for these radiations were determined experimentally and theoretically. The results agree approximately. (J.S.R.)

2003 JEN-14
Spain. Junta de Energia Nuclear, Madrid.
LIBERACIÓN DE NEUTRONES POR FISIÓN DEL URANIO. (Liberation of Neutrons by Uranium Fission). R. Keller, J. M Tharrats, F. Verdaguer, and C. Sanchez Del Rio. 1956. 11p.

The number of neutrons emitted per fission of the uranium nucleus was measured by a method which is a development of that employed by Bradt. The experimental arrangement consisted of a copper sphere (21 cm in diameter) filled with uranium oxide placed in the middle of a graphite cube (101 cm per side). The result is 2.49 ± 0.12 neutrons per fision. (auth)

2004 JEN-18
Spain. Junta de Energia Nuclear, Madrid.
FORMACIÓN DE UN ESTADO ISÓMERO DEL ZN^{67}_{30} MEDIANTE BOMBARDEO CON NEUTRONES LENTOS. (Formation of an Isomeric State of Zn^{67} by Bombardment with Slow Neutrons). J. Montes Ponce De Leon and C. Sanchez Del Rio. 1956. 5p.

In this paper the identification of the isomeric state of Zn^{67} by a new method is described. The isotopes Zn^{66} and Zn^{67} being both stable, the capture of slow neutrons by Zn^{66} leads sometimes to the formation of the isomeric state of Zn^{67}; the state is identified by its half life, measured by delayed coincidences between the capture and the isomeric gamma rays. (auth)

2005 JEN-20
Spain. Junta de Energia Nuclear, Madrid.
BETA DECAY OF Ne^{23}. H. J. Gerber, M. Garcia Muñoz, and D. Maeder. 1956. 4p.

The decay of Ne^{23} was investigated, using scintillation techniques for measuring beta and gamma rays. No gamma ray of 3 Mev was found, however, a gamma ray of 440 ± 5 kev occurs in 36 ± 4% of the beta decays. For both transitions, to the ground state as well as to the 440-kev level of Na^{23}, log ft ≈ 5.2. (W.D.M.)

2006 NP-8031
Tokyo Univ. Inst. for Nuclear Study.
EXCITATION FUNCTIONS FOR ALPHA-INDUCED REACTIONS ON MANGANESE-55. Shigeo Tanaka, Michiaki Furukawa, Takashi Mikumo, Shiro Iwata, Masuo Yagi, and Hiroshi Amano. [1958]. 18p.

Excitation functions for the reactions $Mn^{55}(\alpha,n)Co^{58}$, $Mn^{55}(\alpha,2n)Co^{57}$, $Mn^{55}(\alpha,3n)Co^{56}$, $Mn^{55}(\alpha,\alpha'n)Mn^{54}$, and $Mn^{55}(\alpha,2pn)Mn^{56}$ were measured by the activation method using a stacked-foil technique, the alpha-particle energies ranging from 10 to 40 Mev. Bombardments were made with the alpha-particle beam of 32 and 40 Mev from the 160 cm INSJ cyclotron. The beam was collected in a Faraday cup and measured by a current integrator. After bombardments, manganese, cobalt, and iron were chemically separated. The disintegration rates of product nuclei Co^{58}, Co^{57}, Co^{56}, and Mn^{54} were obtained by the gamma-ray scintillation spectrometry, while that of Mn^{56} by a calibrated end-window type Geiger counter. The reaction cross section was found to agree with calculated value for a nuclear radius constant r_0 of 1.7×10^{-13} cm. Competition between different reactions was analyzed in terms of the statistical model of nuclear reaction by use of a level density expression of $\omega = c \exp[2(aE)^{1/2}]$, and agreed with the calculated values for a = 2 Mev^{-1}. (auth)

2007 AEC-tr-3869
A NOTE ON NATURAL NEUTRON ACTIVITY OF ARSENIC AND ANTIMONY. V. I. Baranovskii (Baranovsky), O. V. Larionov, M. K. Nikitin, and A. A. Tkachenko. Translated by A. L. Monks (Oak Ridge National Lab.) from Vestnik Leningrad. Univ., Ser. Fiz. i Khim., No. 2, 25-6(1959). 3p. JCL or LC.

It was asserted that As and Sb are fast neutron sources. In experiments conducted to determine if the neutrons are produced in secondary processes, Cu, Br, I, Sm, and Rh were activated using pure As and Sb compounds. From energy considerations and experimental results it was concluded that there is no basis for asserting the possibility of a spontaneous neutron decay for these nuclei. (J.R.D.)

2008
BURN-UP IN A URANIUM REACTOR. Ragnar Liljeblad (Asea, Västerås, Sweden). Asea Research No. 2, 123-35 (1959).

A reactor is described which operates continuously with a multiplication factor immediately above 1 and with a continuous replacement of spent fuel elements. Cross sections, etc., are according to the latest information available. Calculations are made for a reactor with natural uranium, for a reactor with U^{235} to 1.5 % and, finally, for a reactor with natural uranium enriched with Pu^{239}. (auth)

2009
THE RADIATIVE CAPTURE CROSS-SECTIONS OF GALLIUM ISOTOPES FOR FAST NEUTRONS. Yu. Ya. Stavisskii and V. A. Tolstikov. Atomnaya Energ. 7, 259 (1959) Sept. (In Russian)

The reaction $T(p,n)He^3$ was used as a source of fast neutrons. At 200 to 1400 kev the neutron energy spread is ± 30 kev and at 1400 to 2000 kev it is ± 50 kev. Bombardment by thermal neutrons was carried out in an experimental reactor thermal column. The cross section for thermal neutron capture by I^{127} (standard used for comparison), Ga^{69}, and Ga^{71} are fixed as 5.6 ± 0.3, 1.4 ± 0.3; and 4.0 ± 0.7 barns, respectively. The cross section of radiative capture in Ga^{69} exhibits a smooth relationship to energy, while that of Ga^{71} drops sharply at ~550 kev. The latter effect is induced by inelastic scattering at energy levels of 510 and 610 kev.

2010

GAMMA-RAY TRANSITIONS IN Cl^{36} FOLLOWING THERMAL-NEUTRON CAPTURE. V. R. Burmistrov. Atomnaya Energ. 7, 260-2(1959) Sept. (In Russian)

Gamma emission following thermal neutron capture by chlorine was studied using the beam from the First Atomic Power Station reactor. Measurements and coincidence studies of γ lines revealed 7.79 to 0.79 and 7.42 to 1.16 Mev cascades with an intensity ratio of 7.8 : 14; the ratio for cascades 6.99 to 1.60 and 6 64 to 1.95 Mev is 1.9 : 14.4. Cascades of 5.72 to 2.88 and 6.11 to 0.51, 0.79 and 1.16 Mev were also present. The latter cascade is confirmed by the coincidence factors of 0.79 to 6.11 and 1.16 to 6.11 Mev. The last cascade follows through the 1.95 Mev level. The coincidences at 1.16 and 6.64 Mev indicate that in addition to the transition from the 1.95 Mev level to the ground state, transitions through the 0.79 or 1.16 Mev levels are also possible. (R.V.J.)

2011

ANGULAR DISTRIBUTION OF THE RADIATION FROM Au^{198} SCATTERED IN THE AIR ABOVE GROUND. V. N. Sakharov, V. I. Kolesnikov-Svinarev, V. A. Nazarenko, and E. I. Zabidarov. Atomnaya Energ. 7, 266-7(1959) Sept. (In Russian)

A Au^{198} source with an activity of ~10,000 C was used in measuring the total radiation intensity at up to 600 m from the source and the angular distribution at 150, 250, and 400 m with the source at 1.5 m elevation. At some points the measurements were made with the source placed at the top of a 25-m pole. The plotted diagrams show that within the limit of counting statistics of the angular distribution changes little with distance from the source. (R.V.J.)

2012

GAMMA-RAYS ACCOMPANYING THE INELASTIC SCATTERING OF 3 MeV NEUTRONS. A. L. Androsenko, D. L. Broder, and A. I. Lashuk. Atomnaya Energ. 7, 268(1959) Sept. (In Russian)

Energy levels were determined by measuring γ rays emitted in inelastic scattering of 3-Mev neutrons. A scintillation spectrometer was used for measuring γ energies for barium, bismuth, chromium, iodine, iridium, strontium, titanium, and tungsten. (R.V.J.)

2013

MEASUREMENT OF CROSS SECTIONS. Bull. inform. sci. et tech. (Paris) No. 31, 41-8(1959) July-Aug. (In French)

Equipment at the disposal of the Service de Neutronique Experimentale and work performed with it are discussed. The equipment described includes the EL2 crystal spectrometer (1954), a Haefely-type CW accelerator for fast neutron generation (1957), a 28-Mev linac, and a high-resolution crystal spectrometer at EL-3 (1958-9). Measurements of cross sections of U^{235}, U^{238}, and U^{239} are reported. (T.R.H.)

2014

EXCITATION OF NUCLEI BY THE ELECTRIC QUADRUPOLE MOMENT OF A PROJECTILE. Mircea Micu. Compt. rend. 249, 1208-10(1959) Oct. 5. (In French)

The contribution of the electric quadrupole moment in coulomb excitation is evaluated. The hamiltonian of the interaction considered represents the energy of the static interaction between the electric quadrupole moment of the projectile and the electric field of the target nucleus. The results obtained seem to be important for high energies. For inelastic scattering of deuterons on Li^6 at 15 Mev and $\lambda = 2$ the value 12 is obtained but the approximation used ceases to be valid for such energies. (T.R.H.)

2015

FORBIDDEN β-TRANSITIONS OF FIRST ORDER. E. V. Chubaryan. Izvest. Akad. Nauk Armyan. S.S.R., Fiz. Mat., Estestven. i Tekh. Nauki 12, No. 2, 107-16(1959).

For the V and A variants of the β-interaction according to Feynmann and Gell—Mann the angular correlation electron—neutrino, the longitudinal polarization of electrons in the case of O—O—transitions, and the longitudinal polarization of electrons for transitions with variation of the nuclear spin (light nuclei) are calculated. (TCO)

2016

SCATTERING OF PROTONS BY SILICON AND SULPHUR. Yukiyasu Oda, Minoru Takeda, Chuin Hu, and Shōhei Kato (Osaka Univ.). J. Phys. Soc. Japan 14, 1255-60(1959) Oct.

The angular distributions of protons in elastic and inelastic scattering by Si and S were studied, changing the bombarding energy from 4.95 to 5.45 Mev with the interval of 100 kev. The angular distributions of proton groups from the reaction $Si^{28}(p,p')Si^{28*}$ ($Q = -1.78$ Mev) are nearly symmetric about 90° for any bombarding energy and the total cross-section changes appreciably with the incident energy. The results for the reaction $S^{32}(p,p')S^{32*}$ ($Q = -2.24$ Mev) show large variation with the energy in both angular distribution and total cross section. The energy dependence of the angular distribution of elastically scattered protons by silicon is found to be more remarkable that that by sulfur in the energy region studied. (auth)

2017

ANGULAR DISTRIBUTIONS OF PROTONS FROM THE REACTION $^{12}C(\alpha,p)^{15}N$. Itaru Nonaka, Hisashi Yamaguchi, and Takashi Mikumo (Univ. of Tokyo); Iwao Umeda and Tasuo Tabata (Kyoto Univ.) and Saburo Hitaka (Kyushu Univ., Japan). J. Phys. Soc. Japan 14, 1260-8(1959) Oct.

Angular distributions of protons corresponding to the ground state transition from the reaction $C^{12}(\alpha,p)N^{15}$ were measured at twelve energies of alpha particles between 25 and 39 Mev. Each angular distribution shows pronounced diffraction-like patterns, but there exists apparently a systematic shift in the shape and magnitude of angular distributions as the energy changes. At lower energies a sharp rise in the backward angles is observed, while at higher energies it is not observed. Angular distributions of protons corresponding to some excited state transitions were also measured at 34.6 Mev. (auth)

2018

EXCITATION FUNCTIONS FOR (p,n) REACTIONS WITH TITANIUM, VANADIUM, CHROMIUM, IRON AND NICKEL UP TO $E_p = 14$ Mev. Shigeo Tanaka and Michiaki Furukawa (Univ. of Tokyo). J. Phys. Soc. Japan 14, 1269-75 (1959) Oct.

The absolute (p,n) cross sections on Ti^{47}, Ti^{48}, V^{51}, Cr^{52}, Fe^{56}, Fe^{57}, Ni^{61}, and Ni^{64} were measured by the activation method at proton energies up to 14 Mev. The experimental results were compared with the predictions based on statistical model in terms of $\sigma(p,n)/\sigma_{total}$, and it was shown that the predictions based on this simple model are not in disagreement with the experiments. (auth)

2019

NUCLEAR MAGNETIC RESONANCE OF Na^{23} IN SODIUM CHLORIDE CRYSTALS. Eizo Otsuka, Yudo Oshio, Toyohide Kobayashi, and Hazimu Kawamura (Osaka City Univ.). J. Phys. Soc. Japan 14, 1454(1959) Oct.

Measurements on two carefully prepared single crystals of NaCl indicate the previously observed Na^{23} resonance line broadening is due to lattice imperfections. (D.E.B.)

2020

FINE STRUCTURE IN THE $N^{14}(\gamma,n)N^{13}$ ACTIVATION CURVE. Naoshi Mutsuro, Yuji Ohnuki, Kazuo Sato, Kosuke Kageyama, and Motoharu Kimura (Tohoku Univ., Sendai, Japan). J. Phys. Soc. Japan 14, 1457-8(1959) Oct.

A number of breaks are reported for the $N^{14}(\gamma,n)N^{13}$ activation curve in the energy region of 10 to ~17 Mev. The breaks are found to correspond to energy levels of N^{14}. It is concluded that the resonance of a single particle may not exist. (C.J.G.)

2021

A $4^+ - 0^+$ CROSS-OVER TRANSITION. Haruhiko Morinaga and Kasuke Takahashi (Tohoku Univ., Sendai, Japan). J. Phys. Soc. Japan 14, 1460-1(1959) Oct.

A $4^+ - 0^+$ cross-over transition is reported in the decay of Ni^{60} at the 2.505-Mev level. The branching ratio of the direct ground state transition from the 4^+ state to the cascade transition was 4×10^{-7}, which compares favorably with the theoretical branching ratio 1.3×10^{-7} obtained by using the Weisskopf single particle estimate. (C.J.G.)

2022

THEORY OF BETA DECAY AND EXPERIMENTAL INVESTIGATIONS OF THE SPECTRA OF FORBIDDEN TRANSITIONS. Denes Berenyi. Magyar Fiz. Folyóirat 6, 251-9 (1958). (Translated from Referat. Zhur. Fiz. No. 5, 1959, Abstract No. 10081).

A survey article devoted to the possibility of determining a variant of beta interaction is presented. The spectra of forbidden beta transitions are analyzed and it is concluded that the most probable are the S, T and V, A variants.

2023

MECHANISMS FOR THE $O^{16}(He^3,He^4)O^{15}$ REACTION. D. A. Bromley, J. A. Kuehner, and E. Almqvist (Atomic Energy of Canada Ltd., Chalk River, Ont.). Nuclear Phys. 13, 1-31(1959) Oct. (1).

Excitation curves for the $O^{16}(He^3,\alpha)O^{15}$ and $O^{16}(He^3;p)F^{18}$ reactions show pronounced resonance structure in the He^3 energy range from 2.0 to 3.0 Mev. It has been previously demonstrated that the energy dependence of the alpha particle angular distribution coefficients in the region of the strongest resonance structure requires interference between compound states with angular momentum $^1/_2$ and $^5/_2$ and like parity at excitations of 10.44 and 10.46 Mev in Ne^{19}. Total and partial widths for both resonances were extracted from the data; the He^3 partial width of the $^1/_2$ resonance is 67% of the single particle limit. In fitting the experimental data, it was necessary to include the energy dependence of the resonance parameters. Alpha particle angular distributions measured between resonances indicate a direct interaction mechanism for the reaction. A small, relatively constant direct interaction reaction amplitude and a markedly energy dependent compound system amplitude which is dominant in the vicinity of compound system resonances are suggested by these measurements. An upper limit of 0.8 μb was established for the He^3 capture cross section proceeding through the $^1/_2$ resonance. (auth)

2024

NEUTRON EVAPORATION AND LEVEL DENSITIES IN EXCITED NUCLEI. K. J. Le Couteur and D. W. Lang (Australian National Univ., Canberra). Nuclear Phys. 13, 32-52(1959) Oct. (1).

The theory of a cascade neutron evaporation process is derived in detail in a form suited to the treatment of highly excited nuclei which have a continuous distribution of excitation energies following a primary direct interaction. The results are found to give good agreement with neutron spectra of nuclei following bombardment with 190 Mev protons observed by Gross. Data from medium energy neutron reactions, thermal energy neutron resonances, and heavy ion reaction experiments are compared. Formulas are derived for the effect on the level density of a gap in the single particle level spacing at the Fermi level. (auth)

2025

SOFT GAMMA RAYS FROM Eu^{152} AND Eu^{154} FOLLOWING RESONANCE NEUTRON CAPTURE. J. E. Draper and A. A. Fleischer (Yale Univ., New Haven). Nuclear Phys. 13, 53-9(1959) Oct. (1).

The gamma-ray spectra up to 300 kev from Eu^{152} and Eu^{154} were measured with a NaI(Tl) scintillator following resonance neutron capture in the 0.33, 0.46, 1.06, and 2.46 ev resonances. Absolute intensities are reported for gamma rays of 95 ± 4 kev from Eu^{152} and 74 ± 4 and 95 ± 4 kev from Eu^{154}. The thermal capture spectrum of Eu was reinvestigated with a lead critical absorber, and the resulting value for the contribution of a prompt ($\lesssim$ 100-μsec delay) ≈ 74-kev gamma ray from Eu^{152} is $\lesssim$ 0.5 photons per 100 captures in elemental Eu. This large discrepancy with the results of Skliarevskii et al., using an unpulsed neutron source, might indicate a new delayed transition. (auth)

2026

β-DECAY OF RaE. B. V. Geshkenbein, S. A. Nemirovskaya, and A. P. Rudik USSR (Academy of Sciences, Moscow). Nuclear Phys. 13, 60-73(1959) Oct. (1).

Effects due to non-conservation of parity in β decay of $RaE(Bi^{210})$ were considered. Expressions for longitudinal polarization of β electrons of RaE and angular distribution of β electrons from an oriented nucleus are obtained, taking into consideration the possibility of time parity non-conservation. (auth)

2027

INELASTIC NEUTRON SCATTERING IN Mn^{55}. N. Nath, M. A. Rothman, D. M. Van Patter, and C. E. Mandeville (Bartol Research Foundation, Swarthmore, Penna.). Nuclear Phys. 13, 74-87(1959) Oct. (1).

Gamma rays excited by inelastic neutron scattering in Mn^{55} were studied. Coincidence methods were used to observe those gamma rays which cascade through the 127 kev first excited state. Branching ratios were measured for four levels, as well as the cross sections for excitation of each level. Theoretical calculations of the cross section, using a diffuse-edge potential well, give good agreement with the experiment, if appropriate spin values are assigned to each level. (auth)

2028

MEASUREMENTS OF (n,p), (n,α) AND (n,2n) TOTAL CROSS SECTIONS AT 14 Mev. C. S. Khurana and H. S. Hans (Muslim Univ., Aligarh, India). Nuclear Phys. 13, 88-91(1959) Oct. (1).

Total cross sections for the following reactions were measured at 14 Mev neutron energy: $Al^{27}(n,p)Mg^{27}$(115 ± 10mb); $Al^{27}(n,\alpha)Na^{24}$(111 ± 9mb); $Sb^{123}(n,2n)Sb^{122}$(1706 ± 120mb); $Sb^{121}(n,2n)Sb^{120}$(453 ± 43mb); $Ag^{109}(n,2n)Ag^{108}$ (619 ± 40mb); $Ag^{109}(n,\alpha)Rh^{106}$(38 ± 6 mb); $Sc^{45}(n,2n)Sc^{44}$(129 ± 9mb); $Sc^{45}(n,\alpha)K^{42}$(132 ± 8mb); $Ti^{50}(n,p)Sc^{50}$(147 ± 13mb); and $Ti^{49}(n,p)Sc^{49}$(97 ± 16mb). (auth)

2029

EVIDENCE OF SOME NEW ISOMERIC STATES. E. C. Campbell and P. F. Fettweis (Centre d'Étude de l'Énergie Nucléaire, Mol, Belg.). Nuclear Phys. 13, 92-4(1959) Oct. (1). (In French)

The half lives and gamma energies of isomeric states of In^{114}, Ir^{194}, Hf^{178}, Ga^{72}, Ba^{135}, Na^{24}, Yb^{175}, and Yb^{177} were determined, and the results are tabulated. To distinguish the (n,γ) reactions from other possible reactions, each irradiation was made with and without Cd shielding. The isomeric level of As^{76m} was detected, which indicates that its limit of sensitivity is approximately 15 msec. The In^{114m} isomer with $T_{1/2}$ = 0.042 sec was not detected, but another isomeric state was found. (J.S.R.)

2030

MEAN LIFE OF THE FIRST EXCITED STATE OF Na^{23}. V. K. Rasmussen, F. R. Metzger, and C. P. Swann (Bartol Research Foundation, Swarthmore, Penna.). Nuclear Phys. 13, 95-103(1959) Oct. (1).

The nuclear resonant scattering by sodium of the 440 kev γ radiation from $Na^{23}(p,p')$ was investigated. From the self-absorption of the resonance radiation the mean life of the first excited state of Na^{23} is found to be 1.8 × 10^{-12} sec. The E2 partial life of this level was previously measured by Coulomb excitation, and the E2/M1 amplitude ratio δ is then 0.056. The theoretical ratio of 151 to 115° nuclear resonant scattering is either 1.06 or 1.20, depending on whether δ is positive or negative. The experimental ratio is 1.10 ± 0.04, suggesting that δ is positive. (auth)

2031

ALPHA-PARTICLE S-STATE BINDING ENERGY. L. Cohen and J. B. Willis (Univ. of Southampton, Eng.). Nuclear Phys. 13, 125-31(1959) Oct. (1).

A variational calculation was made of the principal S-state contribution to the binding energy of the alpha particle using a Yukawa interaction and a radial wave function. The results show a substantial improvement on earlier calculations. The methods used are such that extension to include hard-core interactions would be very straightforward. Monte Carlo methods are used to evaluate the integrals. (auth)

2032

POLARIZATION OF 2- TO 4-MeV NEUTRONS SCATTERED BY DEUTERONS. W. P. Bucher, W. B. Beverly, G. C. Cobb, and F. L. Hereford (Univ. of Virginia, Charlottesville). Nuclear Phys. 13, 164-6(1959) Oct. (1).

The polarization of 2 to 4-Mev neutrons scattered by deuterons was measured by observation of the right-left asymmetry induced in the scattering of polarized neutrons. Results at several energies and scattering angles yield negligibly small values (less than 7%) in agreement with theoretical estimates. (auth)

2033

HARD CORE CORRELATIONS AND NUCLEAR MOMENTS. J. S. Bell and J. M. Soper (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Nuclear Phys. 13, 167-76(1959) Oct. (1).

The influence of hard-core correlations, introduced in the manner of Jastrow, on several shell model matrix elements was considered. The corrections are all found to be very small, and in a number of cases identically zero. (auth)

2034

LIFETIME OF THE 362-keV E1 TRANSITION IN Tb^{159}. F. R. Metzger and W. B. Todd (Bartol Research Foundation, Swarthmore, Penna.). Nuclear Phys. 13, 177-80 (1959) Oct. (1).

Using the Doppler broadening at elevated temperatures, resonance fluorescence from the 362-kev excited state of Tb^{159} was observed. From the magnitude of the resonance scattering effect, assuming a spin value of $^5/_2$ for the excited state and a branching ratio Γ_0/Γ of 0.96, a mean life $\tau_\gamma = (2.0 \pm 0.3) \times 10^{-10}$ s was determined for the gamma-ray transition to the ground state. Internal conversion measurements confirmed the electric dipole character of the 362-kev transition. (auth)

2035

SOME RESULTS ON THE PHOTODISINTEGRATION OF SAMARIUM. G. Di Caporiacco and M. Mandò (Università, Florence and Istituto Nazionale di Fisica Nucleare, Florence) and F. Ferrero (Università, Turin and Istituto Nazionale di Fisica Nucleare, Turin). Nuovo cimento (10) 13, 522 31(1959) Aug. 1.

The total electron capture to β^+ emission of Sm^{143} was determined to be 1.289 times the corresponding value for Pr^{140}. Taking this branching ratio into account the yield of the $Sm^{144}(\gamma,n)$ reaction is shown to be in agreement with the theoretically expected value. Evidence is given for a 74 min. activity, attributable to Sm^{142} from the $Sm^{144}(\gamma,2n)$ reaction; an indication for its K:β^+ ratio is also given. (auth)

2036

ON THE ANOMALOUS BEHAVIOR OF d(γ,p)n NEAR 15 Mev. S. H. Hsieh (Nagoya Univ., Japan) and C. R. Lin (Tokyo Univ.). Nuovo cimento (10) 13, 665-6(1959) Aug. 1.

Photodisintegration of the deuteron shows the angular distribution to have a maximum at E_γ = 15 Mev and a minimum at E_γ = 17 Mev. The reason for these energy boundaries is explained from a physical point of view without detailed numerical computation. (C.J.G.)

2037

ENERGY DISTRIBUTION OF EXTERNAL BREMSSTRAHLUNG FROM β-RAYS OF ^{90}Y. C. Bussolati (Istituto di Fisica del Politecnico, Milan). Nuovo cimento (10) 13, 909-15(1959) Sept. 1.

The external bremsstrahlung spectra from β-rays of Y^{90} attenuated in Al, Ag, and Pb was investigated at 0.4 to 2 Mev. The experimental spectra are compared with theoretical spectra, calculated according to the Bethe-Heitler formula for external bremsstrahlung cross-section. A disagreement (535% for Pb at 2 Mev) increasing with energy and Z-number is shown. (auth)

2038

EFFECTIVE POTENTIAL APPROACH TO THE THRESHOLD BEHAVIOUR OF CROSS SECTIONS. L. Fonda (Indiana Univ., Bloomington). Nuovo cimento (10) 13, 956-68(1959) Sept. 1.

The study of the energy dependence of scattering and reaction cross sections near thresholds was performed by a method which has its basis in the construction of the effective potentials in every single channel. The formalism employed presents some advantage with respect to other kind of approaches in that it gives a simple physical description of the anomaly (cusp or rounded step) which appears in the scattering cross section at the opening up of a new channel. Furthermore, with this method it is effectively possible to give an explanation why the energy derivative of the scattering cross section is infinite when the threshold is approached from below. The effect was found to be purely quantum mechanical. (auth)

2039

THE (γ - α) PHOTOEFFECT IN Ba, Ce, Nd, AND Sm. F. I. Havliček (J. Stefan Institut, Ljubljana, Yugoslavia). Nuovo cimento (10) 13, 969-73(1959) Sept. 1. (In German)

The γ - α photoeffect for Ba, Ce, Nd, and Sm was examined through measurements of traces in photo plates. (tr-auth)

2040

LEPTON CONSERVATION AND TIME REVERSAL IN β-DECAY. H. Schopper and H. Müller (Universität, Mainz). Nuovo cimento (10) 13, 1026-34(1959) Sept. 1.

It is shown that lepton conservation can be checked only in single β-decay experiments. From β-decay experiments results are presented which take into account experimental errors without making theoretical assumptions. It is shown that the negative result found in ordinary time reversal experiments allows no conclusion to be established about time reversal invariance as long as maximum breakdown of parity or conservation of lepton charge has not been established. The β- interaction is mainly A-V, with contributions from S and T smaller than 10%. Parity violation and polarization of neutrinos is only a few percent of the maximum possible value obtained for complete violation of lepton charge conservation. Invariance with respect to time reversal holds with an error of about 15%. The experiments on β-decay prove lepton conservation and a two state theory with an uncertainty of about 15%. (C.J.G.)

2041

ENERGY SPECTRA AND ANGULAR DISTRIBUTION OF PHOTONEUTRONS FROM OXYGEN. C. Milone and A. Rubbino (Università, Catania, Italy and Centro Siciliano di Fisica Nuclare, Catania, Italy). Nuovo cimento (10) 13, 1035-52(1959) Sept. 1.

Energy spectra and angular distribution of photoneutrons from oxygen are investigated by irradiation of a water target with a collimated 31 Mev bremsstrahlung beam. Photoneutrons emitted at Θ angles of 30°, 60°, 90°, 120°, and 150° with a γ-ray beam are recorded by means of proton recoil tracks in Ilford L-4400 μm thick photoemulsions. The neutron spectra analysed in 0.5 Mev steps show a fine structure in good agreement with the fine structure found in the proton spectra and in the (γ,n) and (γ,p) cross sections. From these structures many levels of the O^{16} nucleus are identifyed which are in good agreement with known levels and some levels given with uncertainty are confirmed. For the $O^{16}(\gamma,n)$ reaction the contribution of direct process appears prevalent while for all elements up to this date investigated evaporation accounts for the greater part of emitted neutrons. The ground state transitions amount to at least 60% of the emitted neutrons. The angular distribution of photoneutrons is analyzed separately for single neutron peaks and a back and front asymmetry is found in the region of the giant resonance. Results on the $O^{16}(\gamma,n)$ process up to 31 Mev can be interpreted, in good approximation, in terms of a many-level theory for the giant resonance, single-particle transitions and charge independence of nuclear forces. (auth)

2042

ON THE 1409 kev TRANSITION IN ^{152}Sm. S. K. Bhattacherjee, S. Raman, and B. Sahai (Tata Inst. of Fundamental Research, Bombay). Nuovo cimento (10) 13, 1053-4(1959) Sept. 1.

From the decay of enriched Eu^{152} it was found that the 1409 kev γ ray is fully in coincidence with the 121.8 kev γ ray, giving the highest energy level in Sm^{152} at 1531 kev. (C.J.G.)

2043

NUCLEAR DISINTEGRATIONS PRODUCED BY 900 Mev NEUTRONS. W. T. Morton (Univ. of Glasgow) and B. A. Munir (Univ. of Birmingham, Eng.). Phil. Mag. (8) 4, 933-7(1959) Aug.

Ilford G5 nuclear research emulsions were irradiated with neutrons with an energy of the order of 900 Mev. The characteristics of the disintegrations observed in the heavy nuclei of the emulsion are given and compared with the corresponding results for 950 Mev protons. (auth)

2044

DISSOCIATION OF H_2^+ IONS BY HYDROGEN. D. R. Sweetman (Atomic Weapons Research Establishment, Aldermaston, Berks, Eng.). Phys. Rev. Letters 3, 425-7(1959) Nov. 1.

The cross sections for the four processes contributing significantly to loss of the H_2^+ ions are separately determined. These processes are: $H_2^+ \rightarrow H^\circ + H^+$, $H^+ + e$, $H^\circ + H^\circ - e$, and $H_2^\circ - e$, with cross sections σ_1 to σ_4, respectively. H_2^+ ions accelerated in a 3-Mev Van de Graaff machine were passed through a differentially pumped gas chamber. The beams of neutral particles, H_2^+ ions, and protons were then separated by a magnetic field and detected by 1-in. CsI crystals mounted on photomultiplier tubes. (W.D.M.)

2045

HYPERFINE STRUCTURE OF THE METASTABLE TRIPLET STATE OF HELIUM THREE. J. A. White, L. Y. Chow, C. Drake, and V. W. Hughes (Yale Univ., New Haven). Phys. Rev. Letters 3, 428-9(1959) Nov. 1.

The metastable triplet state (1s2s, $^3S_1$) of the He^3 atom is split by a magnetic field into six energy levels which can be designated by the quantum numbers (F,M). The minimum frequency value, v_{min}, between the $(^3\!/_2, -^1\!/_2)$ and $(^1\!/_2, -^1\!/_2)$ levels is related to the zero-field hf splitting, $\Delta\nu$, by $\Delta\nu = [^3\!/_2\sqrt{2}]\nu_{min}$. The frequency ν_{min} was determined by the atomic beam magnetic resonance method. Resonance lines obtained with two microwave cavities were 40 and 55 kc/sec wide. The final value for $\Delta\nu$ was (6739.7013 ± 0.0004) Mc/sec. (W.D.M.)

2046

MEASUREMENT OF THE NUCLEAR g FACTOR OF Li^8. Donald Connor (Argonne National Lab., Lemont, Ill.). Phys. Rev. Letters 3, 429-31(1959) Nov. 1.

Observation of the asymmetry in beta emission offers a means of measuring the polarization of very small samples of short-lived nuclei. If established resonance techniques are used to perturb the nuclear polarization due to the capture of polarized neutrons, the precise measurement of nuclear g factors should be possible in several cases which cannot be studied by conventional methods. The successful application of this idea to the case of Li^8 is described. The target was a single crystal of LiF enriched in the isotope Li^7. (W.D.M.)

2047

MAGNETIC MOMENT CALCULATION FOR Li^8. Dieter Kurath (Argonne National Lab., Lemont, Ill.). Phys. Rev. Letters 3, 431(1959) Nov. 1.

An intermediate-coupling model calculation of the Li^8 nuclear g factor is compared with a recent measurement. The calculation was carried out as a function of the spin-orbit coupling parameter for the relative range of nuclear forces given by $L/K = 6.8$. The resulting values of the magnetic moment are given. (W.D.M.)

2048

HIGH NUCLEAR EXCITATION AS A NUCLEAR FORCE PROBE. D. B. Beard (Univ. of California, Davis). Phys. Rev. Letters 3, 432-3(1959) Nov. 1.

Particle evaporation experiments at energies in excess of 20 Mev have shown a disappointing fit to the theory of energy level densities in excited nuclei. Temperatures deduced from particle evaporation spectra are too low. This fact is to be expected from actual nuclei because of the diffuseness of the actual nuclear potential well, and level densities of highly excited nuclei are a sensitive measure of the details of the shape of the nuclear potential well. (W.D.M.)

2049

CAPTURE GAMMA RAYS FROM O^{15} AND O^{16} IN THE REGION OF THE GIANT RESONANCE. S. G. Cohen, P. S. Fisher, and E. K. Warburton (Princeton Univ., N. J.). Phys. Rev. Letters 3, 433-4(1959) Nov. 1.

Measurements of the 90° yield ground-state β rays resulting from the capture of protons into the giant resonance region of O^{15} and O^{16} were made using the Princeton FM cyclotron. Measurements were made at 29 proton energies between 9.5 to 15 Mev for the reaction N^{15}(p,γ)O^{16}. The results show two large resonances peaked at 21.8 and 24.7 Mev. The experimental arrangement used to study the N^{14}(p,γ)O^{15} was similar but the results were quite dissimilar. (W.D.M.)

2050

MULTIPLE COULOMB EXCITATION IN Th^{232} AND U^{238}. F. S. Stephens, Jr., R. M. Diamond, and I. Perlman (Univ. of California, Berkeley). Phys. Rev. Letters 3, 435-8 (1959) Nov. 1.

The probability of multiple Coulomb excitation should increase rapidly with increasing projectile charge, and Coulomb excitation in general is most favorable where the rotational level spacings are smallest. With these factors in mind, a search was made for higher than second order Coulomb excitation in Th^{232} and U^{238} by bombarding with Ne^{20}, S^{32}, and Ar^{40} ions. Evidence is presented for excitation up to sixth order in U^{238} and fifth order in Th^{232}. (W.D.M.)

2051

CAPTURE IN (K$^-$,p) ATOMS. Robert K. Adair (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. Letters 3, 438-9 (1959) Nov. 1.

It was concluded by Day et al. Phys. Rev. Letters 3, 61 (1959) that the reactions of K$^-$ mesons at rest in liquid hydrogen almost invariably result from the interaction of the (K$^-$,p) system in states of zero relative orbital angular momentum. Corrections are pointed out to the specific calculations which appear to vitiate largely the specific conclusions that P-state capture cannot be important. (W.D.M.)

2052

SOLUTION OF THE DIRAC EQUATION FOR ELECTROMAGNETIC POTENTIALS. N. C. Rastogi and Vachaspati (Univ. of Lucknow, India). Proc. Indian Acad. Sci., Sec. A 50, 202-5(1959) Sept.

Following the work of Eliezer (1958), a solution of the Dirac electron equation for electromagnetic potentials is presented. Explicit symmetrical expressions are obtained for the potentials in terms of the electron wave function, its derivatives, and a linear combination of the potentials. (auth)

2053

THE SCATTERING OF FAST CHARGED PARTICLES. V. MULTIPLE SCATTERING OF FAST ELECTRONS AND POSITRONS IN XENON. K. Phillips and K. R. Allen (Metropolitan-Vickers Electrical Co., Ltd., Manchester, Eng.). Proc. Phys. Soc. (London) 74, 257-68(1959) Sept.

The multiple scattering of fast electrons and positrons within the energy range of 7 to 17 Mev in xenon was measured using a cloud chamber. A study was made of the errors involved and also the use of the technique of overlapping intervals. At the higher energies the multiple scattering agrees, within the experimental errors, with the theoretical values predicted by Molière but at energies of less than 10 Mev the experimental values tend to be lower. The measured scattering for the mean energy values agree with the predicted values of Molière but are higher than the values given by the theory of Williams. There is no significant difference between the multiple scattering of electrons and positrons. (auth)

2054

ON THE ELECTRON COINCIDENCE SPECTRUM IN DOUBLE BETA DECAY. S. P. Rosen (Washington Univ., St. Louis). Proc. Phys. Soc. (London) 74, 350-62(1959) Sept.

Though simple qualitative arguments imply that the electron coincidence spectra for two-neutrino, and for no-neutrino double β-decay are broadly peaked at $\frac{1}{2}E_0$ and infinitely sharply peaked at E_0, respectively (E_0 is the energy release), a recent calculation has shown that in some circumstances the two-neutrino case spectrum may also be broadly peaked in the region of E_0. A simple model, in which only one state of the intermediate nucleus gives a non-zero contribution to the matrix element, is used to recalculate these spectra. Two extreme approximations are considered; the energy of the intermediate state is equal to, or much greater than, that of the initial state. In both cases, the qualitative result is confirmed, and the recent calculation mentioned above is regarded as incorrect. The model is applied to the double β-decays of Zr^{96} and Ca^{48}. The relation between the conservation of lepton 'charge' and the shape of the spectrum is also considered in some detail. (auth)

2055

AN ANALYSIS OF THE CHARGED PARTICLES EMITTED FOLLOWING NEGATIVE MUON ABSORPTIONS IN PHOTOGRAPHIC EMULSIONS. Chikai Ishii (Tohoku Univ., Sendai, Japan). Progr. Theoret. Phys. (Kyoto) 21, 663-75(1959) May.

Calculations were performed for the energy distribution of alpha particles and protons following the negative muon absorption in photographic emulsions. Three shapes, (I) Chew-Goldberger distribution, (II) Fermi gas at kT = 0, and (III) Fermi gas at kT = 9 Mev, are assumed for the proton momentum distributions in the nucleus. The muon absorption probability is calculated for the single particle process. Assuming that the total kinetic energy of the produced neutron is imparted into the compound nucleus, the statistical theory was applied to emission processes. With the assumption of (III) for Ag and Br, the energy distributions of emitted alpha particles were well explained by the calculations using the statistical theory, but the rate of proton emission has come out to be too small. If it is assumed that most of the produced neutrons were directly emitted, (I) may explain the energy spectrum of emitted particles. In (II), the emission rate is too small. As for the absorption probability, all three shapes show reasonable agreement with experiment. (auth)

2056

COLLECTIVE EXCITATIONS IN SUPERCONDUCTORS. Kei Yosida (Osaka Univ.). Progr. Theoret. Phys. (Kyoto) 21, 731-44(1959) May.

The collective excitations in superconductors are investigated on the basis of the Bogoliubov method. The result obtained by Anderson is confirmed that the plasma frequency in superconductors is completely the same as that in the normal state. It is also shown that the .C.S. Meissner effect is really gage invariant. (auth)

2057

COUPLING CONSTANTS AND THE MASS LEVELS OF BARYONS. Brian Bransden and Gordon Moorhouse (The University, Glasgow). Progr. Theoret. Phys. (Kyoto) 21, 760-2(1959) May.

The limitations placed on the coupling constants of the baryons to the π and K mesons are examined by requiring that the observed masses are obtained correctly by the Tamm-Dancoff approximation applied to the Hamiltonian d'Espagnot and Prentki. In single meson approximation, a system of integral equations was obtained for baryon mass shifts. Using known values of M(B) and assuming three relations in the eight coupling constants, and requiring $f^{-2}_{N\pi} = 0.08$, the equations were solved numerically for a range of values of Mo and for three values of Km, 5.51, 6.60, and 7.80. (C.J.G.)

2058

ELECTROMAGNETIC STRUCTURE OF NUCLEONS. K. Hiida, N. Nakanishi, and M. Uehara (Kyoto Univ.) and Y. Nogami (Univ. of Osaka). Progr. Theoret. Phys. (Kyoto) 21, 762-3(1959)

It is known from the analysis of nuclear force that meson theory is valid in the region $r \gtrsim 1/\mu$. The distribution functions of charge and anomalous magnetic moment are calculated for this region. By comparison of calculated with experimental rms radii, meson theory is examined for validity in the region $1/\mu \gtrsim r \gtrsim 1/M$. (C.J.G.)

2059

ON THE HIGH ENERGY PROTON EJECTED IN THE HIGH ENERGY n-d COLLISSION. Yoshiyuki Sakamoto (Kyoto Univ.). Progr. Theoret. Phys. (Kyoto) 21, 763-6(1959) May.

Using impulse approximation, expressions are obtained for the differential cross section and the polarization of high energy protons ejected in the high energy n-d collision. Wright's notation is used to calculate the coefficients of the n-p scattering spin matrices related with the n-p scattering phase shifts. (C.J.G.)

2060

E1 TRANSITION AND NUCLEAR DEFORMATION IN THE EXCITED STATES. Ila Dutt and Paresh Mukherjee (Saha Inst. of Nuclear Physics, Calcutta). Progr. Theoret. Phys. (Kyoto) 21, 792-8(1959) June.

The equilibrium deformation of some heavy nuclei in the excited states were calculated in the individual particle model of Nilsson. It is found that the deformation remains practically unaltered. With use of Nilsson's eigenfunctions the electric dipole transition probabilities were calculated, and it was found that in most of the cases the retardation is maximum when the deformation of the excited state coincides with that of the ground state. (auth)

2061

USE OF ANTISYMMETRIZED WAVE FUNCTION FOR DEUTERON STRIPPING REACTION. Kôsuke Nakamura (Univ. of Tokyo) and Michitoshi Soga (Tokyo Inst. of Tech.). Progr. Theoret. Phys. (Kyoto) 21, 837-55(1959) June.

The general S matrix of nuclear reaction is derived by the method of second quantization in order to take account of antisymmetrization of the total system. As an example of the general theory, a deuteron stripping reaction is treated. The amplitude obtained by this method is compared with those obtained by other theories in this reaction. The amplitude of this reaction is discussed for a special target which seems to demonstrate the effect of antisymmetrization most clearly. In the case of $O^{17}(d,p)O^{18}$ the effect of antisymmetrization becomes comparable with the direct part. (auth)

2062

THE ELASTIC SCATTERING OF HIGH ENERGY NEUTRON BY DEUTERON. Yoshiyuki Sakamoto and Tatuya Sasakawa (Kyoto Univ.). Progr. Theoret. Phys. (Kyoto) 21, 879-901 (1959) June.

The elastic scattering of high-energy neutrons by deuterons was investigated, using the two-body scattering amplitudes and the deuteron wave functions calculated making use of the meson theoretical potential. It was found that the impulse approximation can well reproduce the experimental result of the differential cross section in the region $\theta \lesssim 90°$ near 100 Mev neutron energy. The phase shifts of nucleon-nucleon scattering and the deuteron wave function derived by using meson theory may give the best fit. The impulse approximation will also be expected to well reproduce the polarization at small angles. The experiment of the polarization may serve as a further test for discriminating various sets of phase shifts of nucleon-nucleon scattering. (auth)

2063

DISTRIBUTION OF RESONANT NEUTRON CAPTURE IN A NATURAL URANIUM ROD-APPLICATION TO NRX ROD 683. S. A. Kushneriuk (Atomic Energy of Canada Ltd., Chalk River, Ont.). Reactor Sci. 10, 133-40(1959) Sept.

A calculation of the neutron resonance escape probability and the radial distribution of resonant neutron capture in a natural uranium rod in the NRX reactor is presented. The calculation uses BNL-325 cross-section data for radiative neutron capture in U^{238} and extrapolates these data by methods derived from the general theory of nuclear reactions into the energy regions in which the BNL-325 information is incomplete. The resonance escape probability so calculated agrees well with the value obtained from the semi-empirical formula. Theoretical values of the average capture cross section in U^{238} in the neutron energy range of 300 ev to 1.2×10^4 ev are also given. (auth)

2064

NEUTRON TEMPERATURE MEASUREMENTS WITH ^{176}Lu. G. A. Price (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Reactor Sci. 10, 157(1959) Sept.

A relative calibration of the $Lu^{176}(n,\gamma)$ reaction is reported. It was found that the $Lu^{176}(n,\gamma)$ reaction is potentially capable of measuring neutron temperature in the 0 to 110°C range to about 5°C. (C.J.G.)

2065

BREMSSTRAHLUNG CROSS-SECTION FORMULAS AND RELATED DATA. H. W. Koch and J. W. Motz (Natural Bureau of Standards, Washington, D. C.). Revs. Modern Phys. 31, 920-55(1959) Oct.

A summary is presented on the bremsstrahlung cross-section formulas which are given in a form convenient for practical calculations. Estimates of their accuracy are given for cases where comparisons can be made with experimental results. Correction factors are indicated in either numerical or analytical form. Data pertaining to electron-electron and to thick target bremsstrahlung are discussed. (C.J.G.)

2066

SPIN AND PARITY OF THE 4.62 MeV LEVEL IN Si^{28}

Lennart Simons. Soc. Sci. Fennica Commentationes Phy. Math. 24, 1-9(1959).

Attempts were made on the basis of the experimental material presently available to resolve between the possibilities of the 4.62-Mev level in Si^{28} having the spin values 2^+ or 1^+ both of which up to now agree with the experimental results. The value 2^+ seems more probable. It is sufficient to determine whether a certain function W(Θ) is falling or rising. Such an experimental investigation would give crucial evidence. (auth)

2067

THE INFLUENCE OF APPARATUS FACTORS ON THE REPRODUCTION OF THE LINE SHAPE IN THE NUCLEAR QUADRUPOLE RESONANCE. V. S. Grechishkin. Vestnik Leningrad. Univ., Ser. Fiz. i Khim. No. 2, 14-19(1959).

The lines of the nuclear quadrupole resonance suffer, by certain inner and outer factors, an extension which makes their investigation more difficult. In this connection, the investigations mentioned in the title on the reproducibility of the line shapes were carried out. The investigations were concerned with the influence of the amplitude modulation on the reproducibility of the mentioned lines. The formula for equivalent frequency modulation in case of nuclear quadrupole reasonance, and magnetic modulation in case of magnetic resonance, is found here which is equal to the formula $S_2^* = S_2^0 + (\nu_m^2/4)$ (1); for the case of separation of a secondary harmonic of the signal, $S_2^* = S_0^2 + (\nu_m^2/6)$ (6) (S_2^* = secondary moment found by experiment, S_2^0 = exact secondary moment). The frequency and Zeeman-modulation from the standpoint of reproducibility of the line shape were also investigated. The distortion is considered here which is caused by the time constant of the phase detector. The expression $S^* = S_2^0 + 2(\nu\tau)^2$ (13) for the secondary moment is obtained. As with the Zeeman-modulation a distortion, as in formulas 1 or 6, is missing, and the use of this modulation is more convenient than the frequency modulation. In the expression (13) v denotes the velocity of passage through the resonance area, τ the time constant of the phase detector. For the intensity of lines, an expression is found here which is inversely proportional to the magnitude of the magnetic field and directly proportional to the width of lines. The surface under the curve remains unchanged. The passage of the signal through an ideal filter of low frequency is considered. The form factor of this correction is represented by a function of the time of transverse relaxation and of the modulation frequency; by some conversions, it passes over into an expression which contains the Krampf function. If the argument of this function is complex, it is oscillating; the frequency of oscillation is represented by the width of lines, the amplitude by the filter band. (TCO)

2068

ON THE PROBLEM OF NATURAL NEUTRON ACTIVITY OF ARSENIC AND ANTIMONY. V. I. Baranovskii, O. V. Larionov, M. K. Nikitin, and A. A. Tkachenko. Vestnik. Leningrad. Univ., Ser. Fiz. i Khim. No. 2, 25-6(1959).

In order to prove that no neutrons are radiated from As and Sb under natural conditions, the same experiments previously described were repeated. The exposition of the materials to be activated was carried out both by direct contact of As and Sb of high purity with activated materials, and with the use of moderators. All investigations proceeded with a negative result. Under experimental conditions as they were used in this investigation, a neutron decay of the As- and Sb-nuclei could have been detected only at a half-life period of $T_{1/2} < 10^{16}$ a. For the self-activation of the said nuclei, the background of the neutron capturing cross section should have been increased which has not been detected either. β-particles from a β-decay with energies ≥0.05 Mev were missing. In all results obtained, a foundation for the assertions by other workers concerning possible independent neutron decay in the As- and Sb-nuclei could not be found. (TCO)

Particle Accelerators

2069 CERN-59-33

European Organization for Nuclear Research, Geneva.
LE SYSTÈME HAUTE FRÉQUENCE DU SYNCHROCYCLOTRON DU CERN. (The High Frequency System of the CERN Synchrocyclotron). Period covered: September 1955—December 1958. K. H. Schmitter. Sept. 22, 1959. 47p.

As an introduction, a résumé is given of the theoretical considerations which led to the selection of the dimensions of the high-frequency system. The ideal frequency, ideal amplitude, and acceleration power are considered in this résumé. The design and construction of the resonator and oscillator are described in some detail. The auxiliary installations described are the input current, control of the oscillator release, and control and monitoring system. The system has operated for 20 months without interruption. Its operating characteristics are given. (J.S.R.)

2070 DESY-A-2.50

Deutsches Elektronen-Synchrotron, Hamburg.
FELDFEHLER UND AUFSTELLUNGSTOLERANZEN FÜR DESY. (Field Error and Assembly Tolerances for DESY). H. O. Wüster. Oct. 6, 1959. 11p.

The effect of faults, which represent a deviation from the ideal structure of the machine, is discussed within the framework of the linear theory of betatron oscillations. The statistical field and gradient errors, the effect of systematic errors, and excitation of betatron oscillations by the synchrotron oscillations are considered. (J.S.R.)

2071 DESY-A2.51

Deutsches Elektronen-Synchrotron, Hamburg.
TECHNISCHE BESCHREIBUNG UND SONDERBESTIMMUNGEN (BESTANDTEIL DES LEISTUNGSVERZEICHNISSES). (Technical Description and Special Determinations (Component Parts of the Specifications)). F. Leonhardt. Sept. 21, 1959. 47p.

A technical description is given of the component parts of DESY, with a consideration of the normal ring tunnel, the ring tunnel in the target area, radial canals, linear accelerator, magnet ring carrier and foundation, experimental halls, and central building. The concrete, steel concrete, and reinforced concrete specifications are described in general, and then in detail for the constituent parts of the machine. (J.S.R.)

2072 DESY-A2.53

Deutsches Elektronen-Synchrotron, Hamburg.
ELEKTRISCHE VERLUSTWÄRME, DIE AN DIE TUNNELLUFT ABGEGEBEN WIRD. (Electric Heat Loss Which is Given up to the Tube). [W.] Bothe. Sept. 22, 1959. 3p.

In the calculation of the air conditioning plant for DESY, the design clearly depends on the losses which are given up to the air in the tube since the heat of conduction is low. The heat losses which are given up to the air were determined as accurately as possible. The heat losses for the various components are tabulated. (J.S.R.)

2073 INSJ-21

Tokyo Univ. Inst. for Nuclear Study.
THE VACUUM SYSTEM OF THE INSJ CYCLOTRON (I).

Hiroo Kumagai, Yoshio Saji, Takashi Karasawa, Satoru Ito, Arata Suzuki, and Yoshitoshi Miyazawa. Sept. 1, 1959. 9p.

The vacuum system of the INSJ 160 cm Synchro- and Variable Energy Ordinary Cyclotron is reported. The ultimate pressure is 1×10^{-3} μHg, the pumping speed is 20,000 l/sec at 0.01 μHg, and the operational vacuum is 0.006 μHg. (auth)

2074 INSJ-22

Tokyo Univ. Inst. for Nuclear Study.
VACUUM SYSTEM OF THE INSJ-CYCLOTRON (II). PERFORMANCE AND STRUCTURE OF THE 32-INCH PUMP. Hiroo Kumagai, Yoshio Saji, Takashi Karasawa, Satoru Ito, Arata Suzaki, and Yoshitoshi Miyazawa. Sept. 1, 1959. 24p.

The performance and structure of the 32-in. oil diffusion pump, the main pump of the INSJ 160 cm Synchro- and Variable Energy Ordinary Cyclotron, are reported. The characteristics of the pump are that it has a high speed in the higher vacuum region and low ultimate pressure. The pumping speed is 20,000 l/sec for air, 35,000 l/sec for helium gas, and 37,000 l/sec for hydrogen gas at 0.01 μHg. The ultimate pressure is 1×10^{-3} μHg. The boiler pressure and the back streaming of oil are measured. The pumping speed of each jet is also measured and some knowledge of pumping mechanism is obtained. (auth)

2075 UCRL-8874

California. Univ., Berkeley. Lawrence Radiation Lab.
CONSTRUCTION OF A HIGH-POWER RF WINDOW. K. C. Crebbin and D. F. Mosier. Sept. 1959. 13p. Contract W-7405-eng-48. OTS.

The construction of a reheatable high-power ceramic window used with a traveling-wave linear accelerator between the accelerator waveguide and the source of rf power is described. This window consists of a high-purity alumina disk mounted in the common wall between two offset sections of rectangular waveguide. This location removes the ceramic disk from direct electron bombardment, in case this is a problem. O.F.H.C. copper is vacuum-cast around the edge of the disk, which is metalized with titanium hydride. A molybdenum washer is cast in the copper centered on the edge of the disk, which reduces the strain on the copper-ceramic joint during subsequent reheats by restricting the expansion of the copper. After being cast, the metalized disk is machined, then vacuum-checked, heated to 500° in hydrogen, cooled and rechecked for vacuum tightness. If still vacuumtight, it is hydrogen-furnace-brazed with a silver-copper eutectic into the waveguide assembly. Windows of this type typically have a voltage-standing-wave ratio (V.S.W.R.) in the range 1.01 to 1.03. One window gave a V.S.W.R. of 1.01 at 2855 megacycles with a V.S.W.R. less than 1.02 for 200 megacycles centered around 2850 megacycles. This type of window was used successfully on four linacs. (auth)

2076

THE ENERGY DISTRIBUTION OF THE PROTON BEAM FROM THE SIX METER SYNCHROCYCLOTRON. I. M. Vasilevskiĭ, Yu. D. Prokoshkin. Atomnaya Energ. 7, 225-30(1959) Sept. (In Russian)

The energy spectrum and mean energy of the proton beam from the Joint Inst. of Nuclear Research Six-meter synchrocyclotron were measured at various accelerations. The spectrum is described by a Gauss curve with dispersion of (2.8 ± 0.3) Mev. The mean energy is determined with an order of accuracy of 0.1%. (tr-auth)

2077

THE INFLUENCE OF SPACE-CHARGE ON THE MOTION OF PARTICLES IN ACCELERATORS. V. I. Kotov and V. A. Pushtarik. Atomnaya Energ. 7, 268-72(1959) Sept. (In Russian)

Effects of space charge on the motion of charged particles were studied considering the screening effect produced by chamber walls and electromagnets. (R.V.J.)

2078

USE OF ELECTRIC-CURRENT SHIMS IN THE CYCLOTRON. J. H. Fremlin, P. W. Hardy, and H. R. Shaylor (Univ. of Birmingham, Eng.). J. Sci. Instr. 36, 390-2 (1959) Sept.

The design and the method of construction of electric-current shims for the Birmingham cyclotron are described. Measurements are given showing the effects of these on magnetic-field distribution. Representative beam-current measurements are given which show that with shim-currents up to 500 a, the method was successful in making possible the acceleration of H^+ or $(He^3)^{2+}$ ions with about the same efficiency as the D^+ ions for which the permanent steel shims were adjusted. (auth)

2079

DESIGN OF ALTERNATING GRADIENT QUADRUPOLE LENSES. Jorge Rosenblatt (Comisión Nacional de Energia Atómica, Buenos Aires). Nuclear Instr. and Methods 5, 152-5(1959) Sept.

A graphical method is described by means of which it is possible to design quadrupole lenses once locations of object and image are given. It is shown that similar procedures would be valid in the para-axial (Gauss) approximation, when applied to electron optical devices of any kind. (auth)

2080

A SYNCHRO-CYCLOTRON PULSE SIMULATOR FOR TESTING ELECTRONIC CIRCUITS. T. Fazzini, G. Fidecaro, and H. Paul (CERN, Geneva). Nuclear Instr. and Methods 5, 156-60(1959) Sept.

An electronic pulse generator is described that can be used to test electronic circuits under conditions of alternating [illegible] and zero counting rate similar to those existing at a synchrocyclotron. It consists of a gated oscillator and a pulse sharpener. (auth)

2081

FOCUSING AND ANALYSIS MAGNETS OF THE SACLAY CYCLOTRON. J. Thirion and J. Saudinos (Centre d'Études Nucléaires, Saclay, France). Nuclear Instr. and Methods 5, 165-9(1959) Sept. (In French)

Two strong gradient magnets are used to deflect and refocus the beam of the cyclotron in both directions. The beam is then analyzed by a double-focusing magnet which gives a definition in energy of 1.5/1000 for 2 mm slits. This analyzer can also be used for analyzing secondary particles. (auth)

2082

EFFICIENT BEAM EXTRACTION FROM A SYNCHROCYCLOTRON AT n = 1. S. Suwa, J. Sanada, T. Karasawa, A. Suzuki, H. Ogawa, H. Yamaguchi, Y. Saji, S. Kikuchi, H. Kumagai, I. Hayashi, K. Matsuda, and K. Nisimura (Univ. of Tokyo). Nuclear Instr. and Methods 5, 189-93 (1959) Sept.

With an electrostatic deflector placed at n = 1 (the point of maximum Br), about 50% of the internal beam (inside n = 0.2) of the 160 cm synchrocyclotron was extracted, and most of the extracted beam was confined within a 2.5 cm diameter area at the tank exit by inserting a magnetic channel acting as a focusing lens. The homogeneity of the magnetic field is essential for this method of beam extraction. The configuration and position of the ion source, and the dee bias voltage were found to affect the transmission of the beam through $n = 0.2$ to $n = 1$. Under the optimum conditions, 70 to 80% of the beam inside $n = 0.2$ reached $n = 1$. (auth)

2083
T.I.F.R. VAN DE GRAAFF ACCELERATOR. K. A. George, A. S. Divatia, M. K. Mehta, S. S. Bhave, C. S. Deshpande, Ram Varghese, and T. G. Varghese (Tata Inst. of Fundamental Research, Bombay). Proc. Indian Acad. Sci., Sec. A 50, 175-82(1959) Sept.

The design of a nonpressurized Van de Graaff accelerator is given. A Philips ion Gage type ion source is utilized. A maximum beam current of 10 μa of H^+ and H_2^+ ion was obtained at a maximum energy of 300 kev. (C.J.G.)

Plasma Physics and Thermonuclear Processes

2084 AFCRC-TN-59-891
Stanford Univ., Calif. Microwave Lab.
THE EXCITATION OF PLASMA OSCILLATIONS. P. A. Sturrock. Sept. 1959. 15p. Project No. 47501. Contract AF49(638)-415. (ML-610).

The theory of Bohm and Gross (Phys. Rev. 75, 1851 and 1864, 1949), and the experiments of Looney and Brown (Phys. Rev. 93, 965, 1954) upon the excitation of plasma oscillations by the two-stream mechanism, which appear superficially to be in disagreement, are here shown to be compatible with each other and with related experiments. (auth)

2085 NP-8017
Convair Scientific Research Lab., San Diego, Calif.
EQUATIONS OF THE ELECTRODELESS RING DISCHARGE AND THEIR SOLUTION FOR THE BREAKDOWN CRITERION. Research Report No. 5. Hans U. Eckert. Aug. 1959. 36p.

For a long cylindrical tube in which a discharge is maintained at medium pressure and moderate input by induction from a surrounding solenoid, differential equations are derived for the distributions of magnetic field H, induced electric field E and conductivity σ. Diffusion is considered the dominant loss factor for electrons, their collision frequency is taken constant and their spatial energy distribution as determined by that of $\bar{E}$. An approximate analytical solution is obtained for the case of vanishing σ at breakdown where $\bar{H}$ is constant and $\bar{E}$ proportional to distance from axis. This, in connection with microwave data for breakdown with uniform $\bar{E}$, allows one to evaluate the rates of ionization across the tube. Near the wall, where it is most critical, the ionization function is approximated by a power law which permits one to solve for σ in terms of Bessel functions. The condition $\sigma = 0$ at the wall yields a relation for the breakdown field $\bar{E}_R$ at the tube wall. $\bar{E}_R$ values obtained for air, H_2, and some noble gases are 40 to 70% higher than with uniform fields. An experimental check of the theory will have to wait for data with purely inductive breakdown which will require considerably larger amounts of radio-frequency power than have been used in previous experiments. (auth)

2086 UCRL-4795
California. Univ., Livermore. Radiation Lab.
ARC RESEARCH PROGRESS REPORT; MIRROR MACHINE PROGRAM. R. F. Post, comp. Oct. 15, 1956. Decl. Oct. 20, 1958. 30p. OTS.

Status and progress as of Oct. 1956 are indicated on the following projects: Table Top II, Felix, $\phi\beta$, P^4System, containment time of β particles in the mirror machine, Saturn Experiment, High Vacuum, Vacuum Techniques, and Theory. (W.D.M.)

2087 SCL-T-282
SPECTROGRAPHIC OBSERVATIONS OF HIGH-INTENSITY DISCHARGES. (Observation Spectrographique de Décharges à Forte Intensité). C. Breton, J. Charon, P. Hubert, and P. Yvon. Translated by Marcel I. Weinreich (Sandia Corp.) from Report CEA-729. 13p. JCL or LC.

Presented at Third International Conference on the Phenomenon of Ionization in Gas, held June 11-15, 1957.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 12492.

2088
A STEPWISE INCREASE IN THE ELECTRON CURRENT TO A PROBE HELD IN A GAS DISCHARGE IN A MAGNETIC FIELD. A. V. Zharinov. Atomnaya Energ. 7, 215-19(1959) Sept. (In Russian)

The effects of a magnetic field on electron diffusion in plasma are investigated. A sudden increase was observed in the ratio of electron current to ion current at certain critical magnetic field intensities. Preliminary data indicate the critical intensity is proportionally to gas pressure. The data show two qualitatively variant mechanisms in transverse electron shifting, one of which is diffusion by means of collision. (tr-auth)

2089
THE DIFFUSION OF ELECTRONS IN A MAGNETIC FIELD. A. V. Zharinov. Atomnaya Energ. 7, 220-4(1959) Sept. (In Russian)

Experimental data on the anomolous fast mobility of electrons across magnetic fields were analyzed. The distribution of secondary plasma concentrations do not depend on the electron transverse diffusion coefficient and cannot be used for clarifying the mechanism of diffusion. Electron diffusion coefficients, estimated according to the density of electron current, confirm the existence of anomalous, high, transverse mobility. (tr-auth)

2090
RESEARCH ON CONTROLLED FUSION. Bull. inform. sci. et tech. (Paris) No. 31, 54-62(1959). (In French)

Research since 1956 on control of fusion is summarized beginning with generalities about the problem. Methods of generating and probing plasma are discussed. (T.R.H.)

2091
RADIO-FREQUENCY CIRCUITS FOR PLASMA PHYSICS. Rodger L. Gamblin (Princeton Univ., N. J.). Electronics 32, No. 27, 50-2(1959) July 3.

A ten-volt 250-kilocycle alternating field generator was found to partially ionize fuel gas in initial stages of thermonuclear fusion process that converts gaseous plasma to helium. Generator design and method of coupling generator to stellarator plasma are considered along with variable load effect of plasma. (J.E.D.)

2092
ELECTROMOTIVE FORCE IN A HIGHLY IONIZED PLASMA MOVING ACROSS A MAGNETIC FIELD. M. Sakuntala, B. E. Clotfelter, W. B. Edwards, and R. G. Fowler (Univ. of Oklahoma, Norman). J. Appl. Phys. 30, 1669-71(1959) Nov.

When a cloud of highly ionized gas flows across a magnetic field, an emf is produced in the gas which is proportional to the speed of flow. Oscillographic probe measurements have been carried out giving the flow speed as a function of position. By drawing currents from the probes the plasma resistance can be found at various distances from the plasma generator. The resistance is shown to be due to the motion of positive ions. (auth)

2093

ELEMENTARY DYNAMICS OF THE NONADIABATIC TRANSVERSE PINCH. Burton D. Fried (Space Tech. Labs., Inc., Los Angeles). J. Appl. Phys. 30, 1778-83 (1959) Nov.

The characteristics of the nonadiabatic transverse (E_θ,B_z) pinch are studied for configurations in which the discharge tube, current coils, and condenser form an integral structure, allowing very high voltage gradients (10^5 to 10^6 v/cm). The dynamics of the first pinch contraction are analyzed using the Garwin-Rosenbluth model of an infinitely conducting, collisionless plasma, and expressions are derived for the parameter values corresponding to maximum energy transfer to the gas for given energy per particle. Theoretical curves of pinch radius, current, and plasma kinetic energy as functions of time for typical cases are shown, and the relative merits of this transverse pinch and the more common longitudinal (E_z,B_θ) pinch are discussed. (auth)

2094

SPACE CHARGE WAVES IN CYLINDRICAL PLASMA COLUMNS. A. W. Trivelpiece and R. W. Gould (California Inst. of Tech., Pasadena). J. Appl. Phys. 30, 1784-93(1959) Nov.

When a plasma is of finite transverse cross section, space-charge waves may propagate even in the absence of a drift motion or thermal velocities of the plasma. Some of the properties of these space charge waves have been investigated by regarding the plasma as a dielectric and solving the resulting field equations. The effect of a steady axial magnetic field is considered, but motion of heavy ions and electron temperature effects are neglected. Waves are found to exist at frequencies low compared with the plasma frequency as well as waves with oppositely directed phase and group velocities (backward waves). Many of the features of these waves have been verified experimentally by measuring phase velocity and attenuation of waves along the positive column of a low pressure mercury arc in an axial magnetic field. Measurements of electron density have been made using these waves and the results are compared with those obtained by other methods. An interesting feature of these measurements, of value in plasma diagnostics, is that they can be made with frequencies which are small compared with the plasma frequency. (auth)

2095

"OPEN-CIRCUIT" VOLTAGES IN THE PLASMA THERMOCOUPLE. H. W. Lewis and J. R. Reitz (Los Alamos Scientific Lab., N. Mex.). J. Appl. Phys. 30, 1838-9(1959) Nov.

The characteristics of the plasma thermocouple from a thermodynamic point of view are extended to the open-circuit voltage cell so as to clarify the mechanism involved. The equilibrium, in vacuum, between a hot thermionic cathode and the associated electron gas is considered. This equilibrium is determined by the equality between the Richardson current flowing out of the cathode and the current into the cathode from the electron gas. (J.E.D.)

2096

MAGNETOHYDROSTATIC EQUILIBRIUM FOR PLASMA IN A TORUS TUBE. Taro Kihara (Univ. of Tokyo). J. Phys. Soc. Japan 14, 1397-9(1959) Oct.

A solution of the magnetohydrostatic problem of finding the equilibrium configuration of a plasma in a slightly bending torus tube with circular cross section is reported. Both the plasma and the tube wall are assumed to be perfectly conducting. The ratio of the tube radius to the radius of curvature, R, of the tube axis is assumed to be so small that its square is negligible. The method is an application of a perturbed cylindrical coordinate system. If an axially symmetric plasma cylinder with the material pressure monotonically decreasing toward the plasma surface is slightly bent into a torus, then two isobaric surfaces are closer in the more distant part from the torus axis than in the less distant part. (auth)

2097

TWO-DIMENSIONAL STOKES FLOW OF AN ELECTRICALLY CONDUCTING FLUID IN A UNIFORM MAGNETIC FIELD. Hirowo Yosinobu (Univ. of Osaka) and Tsunehiko Kakutani (Kyoto Univ.). J. Phys. Soc. Japan 14, 1433-44 (1959) Oct.

The two-dimensional flow of a viscous, incompressible and electrically conducting fluid past a cylinder in a uniform magnetic field was analyzed using Stokes approximation. Detailed calculation is carried out for the flow past a circular cylinder in two cases; one in a parallel magnetic field, and the other in a transverse magnetic field. The expansion formulas for the drag per unit span of the cylinder are obtained in terms of the Hartmann number in each case. (auth)

2098

THERMODYNAMICS OF ELECTRICALLY CONDUCTING FLUIDS. Boa-Teh Chu (Brown Univ., Providence). Phys. Fluids 2, 473-84(1959) Sept.-Oct.

By consideration of the equations of motion and the electromagnetic theory of a moving medium, the reversible work done on a fluid, per unit mass, in a small change of state is shown to be $-p\,d(1/\rho) + E \cdot d(D/\rho) + H \cdot d(B/\rho)$, where p is the pressure due to the joint action of the mechanical and electromagnetic changes; ρ is the density; E and B are, respectively, the electric field strength and magnetic induction; D and H are, respectively, the electric and magnetic excitation. Only the nonrelativistic version of Minkowski's theory has been used in this derivation. This formula provides the basis for a complete study of the thermodynamics of fluid medium under the action of both electromagnetic and mechanical changes. As an application, basic formulas which may be used to calculate the electrocaloric effect, the magnetocaloric effect, and electro- and magnetostriction effects are deduced. In particular, the additional pressure and pondermotive force due to these effects are obtained in a simple manner which, from the thermodynamic point of view, is better than Kortweg and Helmholtz' derivation given in the classical electromagnetic theory. As a second application, the energy equation of magnetohydromechanics is derived. The derivation is more general than previous derivations in that it does not presuppose the form of the electromagnetic constitutive equations (e.g., $D = \epsilon E$, $B = \mu H$) which the medium satisfies. (auth)

2099

COLLISIONLESS PLASMA SHOCK. Stirling A. Colgate (Univ. of California, Livermore). Phys. Fluids 2, 485-93 (1959) Sept.-Oct.

The structure of an extremely strong magnetohydrodynamic shock is discussed in the limit of no particle collisions. It is tentatively concluded that the shock transition takes place through the mechanism of a strong electric field produced by charge separation. The pressure in the shocked plasma is due primarily to a very high electron temperature. The entropy increase occurs by Landau damping of the coherent electron oscillation. The ions, on the other hand, undergo an irreversible temperature change of only 3. (auth)

2100

CONFINEMENT OF PLASMA BY STANDING ELECTROMAGNETIC WAVE. Vincent Cushing and Mahendra S. Sodha (Armour Research Foundation, Chicago). Phys. Fluids 2, 494-8(1959) Sept.-Oct.

The confinement of plasma by a one-dimensional stationary electromagnetic wave is discussed. Their analysis is similar to that carried out by former workers for a $TM_{0,1}$ mode but they have examined the assumptions limiting the applicability of present theories in detail. One of the conditions for the applicability of the present theory is that the frequency of the electromagnetic wave should be of the same order or greater than the plasma frequency at the nodes where particle density is maximum. This condition makes the present theories nonapplicable in cases of thermonuclear interest. (auth)

2101

MAGNETOHYDRODYNAMIC WAVE OF FINITE AMPLITUDE AT MAGNETIC PRANDTL NUMBER 1. Hidenori Hasimoto (Johns Hopkins Univ., Baltimore). Phys. Fluids 2, 575-6(1959) Sept.-Oct.

2102

ON THE TIME-VARIATION IN THERMONUCLEAR-FUSION SYSTEMS. Saburo Fujii and Mitsuo Imoto (Nihon Univ., Tokyo) and Goro Tominaga (Univ. of Tokyo). Progr. Theoret. Phys. (Kyoto) 21, 758-9(1959) May.

The relations between thermonuclear reactions and stellar evaluation are studied relative to energy balancing in thermonuclear reactors. Solutions of the basic equations involving energy balancing and dependent on the compound parameter τ are given. (C.J.G.)

2103

T-Nt DIAGRAM FOR FUSION RESEARCHES. Mitsuo Imoto (Kyoto Univ.); Goro Tominaga (Tokyo Univ.); and Saburo Fujii (Nihon Univ., Tokyo). Progr. Theoret. Phys. (Kyoto) 21, 939-41(1959) June.

It is shown that the energy balancing conditions common to any thermonuclear reactor system can be plotted in T-τ space to form regions of "narrow sense" (the balancing of produced power with loss at each instant) and "wide sense" (balancing the integrated produced energy with integrated loss for the whole duration of operation). An T-Nt diagram is shown for fixed fuel of deuterium with 50% tritium. (C.J.G.)

2104

MICROWAVE MEASUREMENTS OF ELECTRON DENSITIES IN IONIZED GASES. W. Low (Hebrew Univ., Jerusalem) and Y. Manheimer (Ministry of Defence, Israel). p. 20-4 of "IXth International Astronautical Congress, Amsterdam, 1958, Proceedings. [Vol.] I." F. Hecht, ed. Vienna, Springer-Verlag, 1959. p.1-506.

The electron density in thermally ionized air produced in a shock-tube was calculated from measurements of the attenuation of a microwave beam. Results obtained show that thermal equilibrium is reached in a very short time. (auth)

2105

APPLICATION OF ELECTRIC-ARC PLASMA GENERATORS TO PROPULSION. M. E. Malin, R. John, W. Bade, R. Schweiger, and J. Yos (AVCO Mfg. Corp., Lawrence, Mass.). p. 445-55 of "IXth International Astronautical Congress, Amsterdam, 1958, Proceedings. [Vol.] I." F. Hecht, ed. Vienna, Springer-Verlag, 1959. p.1-506.

A description is presented of the operation of water-and gas-stabilized arcs. Experimental estimates are included of electrode erosion rate, nozzle heat transfer, and efficiency of conversion of electrical energy to gas enthalpy. A discussion of the idealized propulsion performance of the electric arc plasma generator is included. (auth)

2106

PLASMA MOTORS: THE PROPULSION OF PLASMA BY MAGNETIC MEANS. Winston H. Bostick (Stevens Inst. of Tech., Hoboken, N. J.). p. 794-808 of "IXth International Astronautical Congress, Amsterdam, 1958, Proceedings. [Vol.] II." F. Hecht, ed. Vienna, Springer-Verlag, 1959. p.507-970.

It has been experimentally demonstrated that speeds of the order of 10^7 cm/sec can be obtained by the propulsion of plasmas by magnetic forces resulting from high electrical current passed through the plasma. In order to increase the efficiency of energy transfer from the capacitor in which the energy is stored to the kinetic energy of the plasma, it is desirable that the gun be spread out over a distance of a large fraction of a meter in order that a discharged current can act upon the plasma for an appreciable length of time. The relationships for energy transfer in various types of rail-type plasma guns and motors are examined. Also discussed is the efficiency of energy transfer in the induction or electrodeless type of gun. It is shown that with the rail-type guns with a length of the order of a meter with currents of the order of 10^4 amperes and externally excited fields of the order of 10,000 gauss, speeds of the order of 10^8 cm/sec and a back e.m.f. of the order of 20 kilovolts can be expected. This high a back e.m.f. suggests that it is possible to extract most of the energy of the capacitor and transform it into kinetic energy of the plasma in the first half cycle of current. (auth)

Shielding Calculations

2107

ON THE OPTIMUM SHAPES OF SHIELDING ELEMENTS. L. R. Kimel. Atomnaya Energ. 7, 265-6(1959) Sept. (In Russian)

A geometric scheme is plotted for determining the shape of an optimum weight shielding element for an evenly distributed linear source. The derived equation $r = f(\varphi)$ describes the shape of the shielding barrier. An analogous procedure was used for disc shaped sources. Dosage variations at the radiation scattering point were not considered in the calculations. (R.V.J.)

2108

PROTECTION AGAINST γ RADIATION. GRAPHIC DETERMINATION OF SHIELDS. G. Vacca (Commissariat à l'Énergie Atomique, Paris). J. radiol. et électrol. 39, 498-504(1958). (In French)

A set of abaci with which the thickness of γ radiation shields may be determined are presented. For monoenergetic radiation, the result may be read directly without any calculation. In the case of multiple gamma energies, the thickness required can be estimated with very simple calculations. The principles of the calculation are briefly described, and the method of using the abaci is illustrated. (tr-auth)

2109

ON NEUTRON PENETRANCE OF INDUSTRIAL GLASSES. Werner Espe. Strojnoelektrotechnicky casopis 9, No. 3, 168-71(1958). (Translated from Referat. Zhur. Khim. No. 2, 1959, Abstract No. 5494).

Analyzing the coefficient of specific absorption of neutrons (Ns) by various oxides taking part in the composition of glass (G), it was concluded that ordinary industrial Gs are characterized by a great neutron penetrance. On the contrary, G containing oxides of Cd, B, Gd and Eu, absorbs neutrons very efficiently. Indium oxide possesses an exclusively great capacity of selective absorption of neutrons of an energy of 1.4 electron-volt. Recipes for, and properties of, some Gs designed for protection from neutrons are presented.

Theoretical Physics

2110

STUDIES OF MANY-PARTICLE SYSTEMS BY QUANTUM MECHANICS. Bull. inform. sci. et tech. (Paris) No. 31, 6-14(1959) July-Aug. (In French)

A summary is made of the problems posed by many-particle systems, and the methods used in solving them. The methods discussed are divided into three types: effective fields, quasi-particles, and perturbation. (T.R.H.)

2111

DIRECT INTERACTION IN THE THEORY OF NUCLEAR REACTIONS. Bull. inform. sci. et tech. (Paris) No. 31, 15-26(1959) July-Aug. (In French)

The direct interaction theory has contributed some new concepts to the study of nuclear reactions, and it also explains experimental results in contradiction to the compound nucleus theory. It is shown how the new theory is applied and the particular problems involved. (T.R.H.)

2112

TRANSFORMATION BRACKETS FOR HARMONIC OSCILLATOR FUNCTIONS. Marcos Moshinsky (Universidad de México and Instituto Nacional de la Investigacíon Científica, México City). Nuclear Phys. 13, 104-16(1959) Oct. (1).

The transformation brackets connecting the wave functions for two particles in a harmonic oscillator common potential with the wave functions given in terms of the relative and center-of-mass coördinates of the two particles are defined. With the help of these brackets it is shown that all matrix elements for the interaction potentials in nuclear shell theory can be given directly in terms of Talmi integrals. The recurrence relations and explicit algebraic expressions are obtained for the transformation brackets which permit their numerical evaluation. (auth)

2113

INTRASHELL-INTERACTION LEVELS AND THEIR EXCITATION BY MULTICHARGED IONS. V. I. Gol'danskii (Gol'dansky) and M. V. Kazarnovskii (Kazarnovsky) (Lebedev Inst. of Physics, Moscow). Nuclear Phys. 13, 117-24(1959) Oct. (1).

On the basis of the shell model of the nucleus the existence of the whole series of hitherto unknown nuclear levels arising from the interaction of nucleons in a given shell is anticipated. Many of these levels possess angular momenta which strongly differ from those of the ground state, although their energy above the ground state is sufficiently low. The most efficient method of excitation of such levels would seem to be by bombardment of nuclei with multicharged ions. The theory of excitation of low-lying levels by inelastic scattering of complex nuclei is considered. New cases of nuclear isomerism may be produced by low energy E2 transitions between intrashell-interaction levels. (auth)

2114

UNSTABLE STATES AND THE SEPARABLE POTENTIAL MODEL. D. B. Fairlie (Pembroke Coll., Cambridge, Eng.) and J. C. Polkinghorne (Trinity Coll., Cambridge, Eng.). Nuclear Phys. 13, 132-5(1959) Oct. (1).

A model based on a separable potential is investigated, and it is shown that the unstable states can be associated with poles of the continuation of the scattering amplitude into the second Riemann sheet. (auth)

2115

ON THE BOSON MASS RENORMALIZATION CONSTANTS IN PSEUDOSCALAR MESON THEORY. John W. Moffat (RIAS, Baltimore). Nuclear Phys. 13, 150-5(1959) Oct. (1).

The significance of Lehmann's theorem, which states that for pseudoscalar mesons $\delta m^2 \leqq 0$, is investigated. This theorem prevents one from ascribing the meson mass to self-mass effects alone. By including a $\lambda\phi^4$ term in the Lagrangian, it is proved that Lehmann's theorem is no longer necessarily fulfilled. On the basis of this conclusion one can no longer exclude the possibility that the mass of the meson in the absence of interaction is zero, and that the ϕ^4 coupling produces most of the observable meson mass. However, in view of the singular behavior of the modified propagator the vacuum expectation value $\langle\phi^2\rangle_0$ is divergent and δm^2 appears to be either infinite or indeterminate. (auth)

2116

ON THE INCLUSION OF HOLE-HOLE SCATTERING IN THE BRUECKNER t-MATRIX. J. S. R. Chisholm (University Coll., Cardiff, Wales). and E. J. Squires (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Nuclear Phys. 13, 156-63(1959) Oct. (1).

A discussion is given of the effect of including hole-hole scattering terms in the Brueckner t-matrix method applied to large fermion systems with attractive separable potentials. The nature of the singularity in the t-matrix equation is considerably altered, and, for the infinite system, the new t-matrix can be written as the sum of a non-singular form and a δ-function. (auth)

2117

THE LORENTZ-COVARIANT APPROXIMATION METHOD IN GENERAL RELATIVITY. [PART] I. R. P. Kerr (Trinity Coll., Cambridge, Eng.). Nuovo cimento (10) 13, 469-91(1959) Aug. 1.

The Lorentz-covariant approximation method for the field outside a set of localized particles was analyzed. It is found that as well as the usual equations of motion and energy derived by Einstein, Infeld, and Hoffman for the quasi-static approximation, there are three further equations, the equations of spin, which must be satisfied by the structural parameters of each particle. These equations also appear as surface integral conditions in the quasi static approximation. Furthermore, it is shown that it is not necessary to expand the mass, dipole, or spin parameters, those introduced into the lowest approximation being the physical particle parameters. It is only the differential equations satisfied by these parameters that change in the higher orders. (auth)

2118

ON THE LORENTZ-COVARIANT APPROXIMATION METHOD IN GENERAL RELATIVITY. II. SECOND APPROXIMATION. R. P. Kerr (Trinity Coll., Cambridge, Eng.). Nuovo cimento (10) 13, 492-502(1959) Aug. 1.

The equations of motion and spin are calculated to the second approximation by the Lorentz-covariant method in general relativity. The results are derived from the field outside the particle. (C.J.G.)

2119

ONE PARTICLE SINGULARITIES OF GREEN FUNCTIONS IN QUANTUM FIELD THEORY. W. Zimmermann (Univ. of California, Berkeley). Nuovo cimento (10) 13, 503-21 (1959) Aug. 1.

The general structure of the vacuum and the one particle singularities of the τ-functions are investigated. In the case of forward scattering the analytical continuation method was applied to dispersion relations to determine the indefinite constant appearing in Bogoljubov's treatment of the one particle singularities. The result obtained is in good agreement with Symanzik's form of the one particle term in the dispersion relation for forward scattering. (C.J.G.)

2120

GRAVITATIONAL RED-SHIFT IN NUCLEAR RESONANCE. R. V. Pound and G. A. Rebka, Jr. (Harvard Univ., Cambridge, Mass.). Phys. Rev. Letters 3, 439-41(1959) Nov. 1.

The several theories of relativity predict the frequency of electromagnetic spectral lines to be proportional to the gravitational potential. Experiments are proposed to observe the timekeeping of a "clock" based on an atomic or molecular transition, when held aloft in a rocket-launched satellite, relative to a similar one kept on the ground. Methods for testing this on the ground are discussed. (W.D.M.)

2121

THE RUIJGROK-VAN HOVE MODEL OF FIELD THEORY IN TERMS OF "DRESSED" OPERATORS. Jan Łopuszanski (Instituut voor Theoretische Fysica der Rijksuniversiteit, Netherlands). Physica 25, 745-64(1959) Sept.

A "dressing" transformation for the Ruijgrok-Van Hove model of field theory is given. By means of this transformation the Hamiltonian is expressed in terms of "dressed" operators only. It is shown that the Hamiltonian depends explicitly on the cut-off. The solution of the eigenvalue problem is given for one meson present in addition to the "dressed" nucleon. It also depends on the cut-off. A ghost state with negative norm as well as a bound state with positive norm are found, both belonging to the same energy value. The solution for one nucleon and several mesons is outlined. A detailed discussion of the metric in Hilbert space is given. It is shown that the "bare" particle representation is not adequate to describe the system considered. The most suitable representation, from the physical and mathematical point of view, seems to be the asymptotic stationary states representation, introduced by Van Hove. A test as to the merits of these two representations is given in the case of indefinite metric; here the "bare" particle representation can no longer be used to describe the system, in contrast to the asymptotic stationary states representation which can be employed with success. (auth)

2122

THE IMAGINARY PART OF THE OPTICAL POTENTIAL. Atsushi Sugie (JAERI, Tokai-mura, Ibaragi-ken, Japan). Progr. Theoret. Phys. (Kyoto) 21, 681-95(1959) May.

The form of the imaginary part of the optical potential is derived as an operator for the finite nucleus. This is done by reducing the Schroedinger equation approximately. It is essentially a second order calculation but is supported by the intermediate coupling model and the assumption that the non-diagonal elements of the interaction matrix have random signs. The imaginary part thus obtained is a non-local but almost separable potential. The form allows the physical interpretation that the imaginary part corresponds to the process in which the incident nucleon jumps down to an unoccupied single particle state below the incident energy and excites the target nucleus making the total energy nearly conserved. It is suggested that the imaginary part may become abruptly stronger as the shape resonance is passed since in this case there is a single particle state just below the incident energy and the corresponding excited states of the target are near the ground state. The relation to Bloch's theory is also discussed. (auth)

2123

STATISTICAL NUCLEI WITH REPULSIVE CORE INTERACTION. Takehiko Ishidzu (Univ. of Tokyo). Progr. Theoret. Phys. (Kyoto) 21, 766-8(1959) May.

The usual statistical theory of nuclei was developed for the two-body interactions for nucleons. An expression for the total energy of nuclei was obtained by adopting for the interaction V_{ik} the symmetrical theory of nuclear forces. From this expression, theoretical values were obtained for the four parameters r_0, β, α^2, and $a'J_0$. (C.J.G.)

2124

A STUDY OF CHARGE INDEPENDENCE IN TERMS OF KALUZA'S FIVE DIMENSIONAL THEORY. Osamu Hara (Nihon Univ., Tokyo). Progr. Theoret. Phys. (Kyoto) 21, 919-37(1959) June.

An attempt is made to give a foundation to the charge independence based on the five dimensional theory proposed by Kaluza. It is shown that the fifth co-ordinate can be identified with the angular variable of the charge space describing the rotation around its third axis, and that a transformation with respect to this co-ordinate proposed by Klein as a generalization of the gage transformation is isomorphic to the rotation in a three dimensional Lorentz space. It is shown that this space has a close relation to the charge space. (auth)

2125

GENERALIZATION OF CERTAIN RESULTS IN THE PROBLEM OF THREE-BODY COLLISION. Dobrivoje Mihailović. Publikacije Elektrotehničkog Fak., Univ. Beogradu, Ser. Mat. i Fiz. No. 12, 1-32(1957). (Croatian)

Certain results from H. G. Blok's work on the quantitative analysis of the problem of collision of three bodies are generalized. The relation between the problem of collision of three bodies and the problem of fission of a single body into three parts (Milankovic problem) is established. This is based on the fact that the first is deduced from the second if one specifies in the latter the nature of the forces. (T.R.H.)

2126

FOUNDATIONS OF THE OPTICAL MODEL FOR NUCLEI AND DIRECT INTERACTION. G. E. Brown (Univ. of Birmingham, Eng.). Revs. Modern Phys. 31, 893-919 (1959) Oct.

Several modifications of the compound-nucleus theory are presented by employing the formalism of Kapur and Peierls. In the explanation for giant resonances in the extreme compound-nucleus picture, a complex well is used to represent the nucleus. The predictions of the compound-nucleus model, supplemented by statistical assumptions, are used to explain the inelastic scattering of nucleons by complex nuclei and the giant dipole photoeffect. From an exact description in terms of nuclear·dispersion theory a unified description of the above phenomena is given. The scattering amplitude is separated into terms corresponding to direct interactions and compound-nucleus processes.

Perturbation theory is developed by an expansion in $\delta V = V(\tau,\xi)-\widetilde{V}(\tau)$ and an expansion of the type used by Bruckner, Eden, and Francis which essentially relates quantities back to shell-model states. This development can be generalized so that $V-\overline{V}$ is a matrix between chosen channels, $|o>$ becoming the space of the chosen channels and Λ_o excluding these from occurring in intermediate states, essentially reproducing Yoshida's formalism. This generalization is like the optical model where the distortion provided by the central potential is supposed to represent the average effects from the great number of channels and correspondingly large number of degrees of freedom which cannot be conveniently treated in detail. The formulation of a unified theory of nuclear reactions by Feshbach is discussed and a review is given on the dispersion theory of Kapur and Peierls and the nucleon-nucleon forces of formalisms developed by Lane, Thomas, and Wigner. (C.J.G.)

2127

LECTURES IN THEORETICAL PHYSICS. VOLUME I. Lectures Delivered at the Summer Institute for Theoretical Physics, University of Colorado, Boulder, 1958. Wesley E. Brittin and Lita G. Dunham, eds. New York, Interscience Publishers, Inc., 1959. 419p.

Seven lectures delivered at the Summer Institute of Theoretical Physics, University of Colorado, are included. Separate abstracts have been prepared for each lecture. (D.E.B.)

2128

PAIR PRODUCTION AND BREMSSTRAHLUNG IN THE FIELD OF AN ATOM. F. Rohrlich (State Univ. of Iowa, Iowa City). p.1-29 of "Lectures in Theoretical Physics. Volume I."

The processes of pair production and bremsstrahlung are studied relative to photon collisions on an atom. The special cases where the struck particle is a nucleus and where it is a free electron are discussed separately. The effects of screening are discussed and expressions are given for obtaining the coherent and incoherent scattering functions and coherent and incoherent cross sections. (C.J.G.)

2129

STRANGE PARTICLES AND THEIR INTERACTIONS. Berthold Stech (Univ. of Heidelberg, Ger.). p.82-119 of "Lectures in Theoretical Physics. Volume I."

The properties and conservation laws for elementary particles are reviewed. A discussion of strong and weak interactions occurring in the production and scattering processes of strange particles is contained. (C.J.G.)

2130

SOME ASPECTS OF THE STATISTICAL-MECHANICAL THEORY OF IRREVERSIBLE PROCESSES. Ryogo Kubo (University of Tokyo). p.120-203 of "Lectures in Theoretical Physics. Volume I."

The general features of the quasi-thermodynamical theory of irreversible processes at equilibrium are given. The relation of phenomenological coefficients to fluctuation processes is discussed and the original proof of the Onsager relations is described. The response of phenomenological coefficients to linear dissipative systems is examined and general expressions of admittance and symmetry relations including the dissipation—fluctuation theorem, sum rules, and the Einstein relation for conductivity are given for the system. Expressions are derived for external perturbations which are macroscopic in nature for linear dissipative systems and illustrated by the example of electron transport phenomena in solids. Several examples are given to illustrate the energy process between two bodies which are in contact. Equations for the calculation of magnetic resonance and Gaussian and Markoffian models for the calculation of motional narrowing of the linear system are given. An attempt is made to justify the use of transport equations for external perturbations of the systems. (C.J.G.)

2131

MULTIPLE PRODUCTION OF MESONS AND A NONLOCAL THEORY OF FIELDS. G. Wataghin (Univ. of Turin). p.204-37 of "Lectures in Theoretical Physics. Volume I."

An analysis of the angular and momentum distributions in cosmic ray jets, specifically related to nucleon-nucleon collisions in which relativistic shower particles are created, is given. The models proposed by Fermi, Heisenberg, and Landau to explain the phenomenon of jets are discussed. A nonlocal, relativistic field theory is derived for 4-dimensional domains of interaction and illustrated by the Lee model for which the stationary Schroedinger equation is written and solved exactly. A theory of multiple production based on the assumption of the existence of a nonlinear Hamiltonian is derived. Strict validity of the homogeneous Lorentz transformation in the momentum variables and of the conservation of the total energy-momentum 4-vector is assumed, as well as validity of conservation of baryon number, total angular momentum, and the law of electric charge. (C.J.G.)

2132

SELECTED TOPICS IN NUCLEAR THEORY. R. E. Peierls (Univ. of Birmingham). p.238-314 of "Lectures in Theoretical Physics. Volume I."

The relation of the shell model to the basic two-body forces of a many-body problem is examined by means of Hartree and Hartree-Fock approximations. Expressions developed by Euler, Brueckner, Bethe, and Goldstone in relation to the two-body problem are discussed. The use of an optical model to explain nuclear reactions is discussed from the point of view of time-dependent perturbation and closely follows a procedure developed by Kapur and Peierls. This procedure involves a linear relation between the scattering amplitude and a sum of resonance terms. The collective degrees of freedom in the nucleus are discussed relative to rotational and vibrational states and the motion of the center of mass. (C.J.G.)

2133

HIGH-ENERGY COLLISION THEORY. R. J. Glauber (Harvard Univ., Cambridge, Mass.). p.315-414 of "Lectures in Theoretical Physics. Volume I."

Several approximation methods which describe the physical conditions of collisions of particles accelerated to high energies are presented. A general discussion of elastic scattering by a static potential is given with emphasis on theorems regarding scattering amplitudes. A high-energy approximation is developed for one- and three-dimensional problems and compared to the Born and W.K.B. approximation methods. The optical model for elastic scattering is used to illustrate the way in which the optical potential depends on the fluctuations and correlations in the positions of the individual nucleons. (C.J.G.)

2134

ELEMENTS OF SOLID STATE THEORY. Gregory H. Wannier. Cambridge, Eng., University Press, 1959. 274p.

An outline of the theory behind present-day solid state physics is presented. The scope of information is limited; some topics of current interest are missing altogether, and others are included in skeletanized form only. To minimize this inconvenience, a bibliography of comprehensive articles is appended to each chapter through which the topics discussed in the book may be opened up fully. (J.R.D.)

2135
FIELD THEORY. PART I. CLASSICAL THEORY. Jan Rzewuski. Warsaw, Panstowowe Wydawnictwo Naukowe, 1958. 297p.

The most important physical principle is the principle of special relativity which requires invariance of any physical theory with respect to the Lorentz group of transformations. This is used as the starting point for the considerations given. The general form of the field equations and the conservation laws are derived from a dynamical principle. Several examples are discussed to illustrate the general treatment given. A detailed analysis of the singular solutions of the Klein-Gordon and Dirac equations is given. (W.D.M.)

REACTOR TECHNOLOGY

General and Miscellaneous

2136 ANL-6025
Argonne National Lab., Lemont, Ill.
PHYSICS ANALYSES OF THE TREAT REACTOR DESIGN. Haig P. Iskenderian. Aug. 1959. 49p. Contract W-31-109-eng-38. OTS.

The results of physics calculations, based on an analysis of five graphite-moderated and -reflected critical assemblies built on the Los Alamos honeycomb facility, to determine the loading of the TREAT reactor are reported. The method of treatment consisted of three-group diffusion equations converted to a modified Fermi age theory, allowing for epithermal absorption and fission. A simple treatment of the TREAT reactor characteristics for transient studies, such as neutron lifetime, negative temperature coefficient, and reactor period, has been obtained. The results of control rod calculations are also given. (auth)

2137 CNC-16
Italy. Comitato Nazionale per le Ricerche Nucleari. Divisione Studi e Ricerche, Rome.
PRODUZIONE DI PLUTONIO NEI REATTORI NUCLEARI. (Plutonium Production in Nuclear Reactors). V. Benzi and G. Solinas. Sept. 1959. 26p.

In order to reduce the labor required to determine the Pu production of a given thermal reactor, numerical tables are presented. By means of these tables it is possible to evaluate the isotopic components as a function of temperature, integrated flux, and a parameter depending on initial conversion factor, for a given fuel enrichment. (auth)

2138 GEAP-1040
General Electric Co. Atomic Power Equipment Dept., [Schenectady, N. Y.].
CORE HEAT TRANSFER IN LOCKHEED RADIATION EFFECTS REACTOR AND SHIELD DEVELOPMENT REACTOR. R. O. Niemi and K. M. Horst. Apr. 24, 1957. 22p. (LAC-DA-6).

Solutions to the heat transfer problems are presented of the core components of the Radiation Effects Reactor. These components include the fuel elements, control rods, regulating rod, dummy fuel elements, beryllium reflector pieces, and start-up source. The results of the heat transfer in the fuel elements of the Shield Development Reactor are also presented. The core design and coolant flow rate is identical to the RER, and the power half that of the RER, therefore, the remaining components will operate satisfactorily. (auth)

2139 GEAP-3178
General Electric Co. Atomic Power Equipment Dept., San Jose, Calif.
METAL—WATER REACTIONS: II. AN EVALUATION OF SEVERE NUCLEAR EXCURSIONS IN LIGHT WATER REACTORS. J. I. Owens. June 15, 1959. 34p. Contract AT(04-3)-189. OTS.

An evaluation of the power and temperature versus time histories of three typical water-cooled and moderated reactors during a nuclear excursion was made by applying a previously reported method of analysis. These reactors are characterized by one of the following types of fuel elements: U—Al alloy, highly enriched, aluminum jacketted, flat plate; U—Zr alloy, highly enriched, zirconium clad, flat plate; and UO_2, slightly enriched, zirconium clad rods. The validity of the method of analysis was evaluated by comparing the results with experimental data derived from the BORAX I and SPERT I tests. The effects of varying some of the input data, such as heat transfer coefficients, and of considering various nuclear shutdown mechanisms were also obtained. (auth)

2140 GEAP-3191
General Electric Co. Atomic Power Equipment Dept., San Jose, Calif.
METAL—WATER REACTIONS: III. FUEL ELEMENT STRESSES DURING A NUCLEAR ACCIDENT. K. M. Horst. July 24, 1959. 26p. Contract AT(04-3)-189. OTS.

The thermal and pressure stresses in metallic plate and rod type nuclear fuel elements during a nuclear accident severe enough to produce a metal-water reaction have been reviewed. The initial reactor periods required to cause these severe accidents are in the range of 4 to 12 milliseconds. The result of the stress review presented in this report indicates that the metallic plate type fuel will swell from internal fission gas pressure, the rate of gas generation, and the magnitude and exposure to elevated central temperatures. Pulsed irradiation type experiments on sample fuel elements are desirable to determine the extent and consequences of this swelling including determination of the mechanism of fuel element failure and if dispersion occurs, measurement of the size of the particles. The stress review for the clad oxide rod type fuel, indicates that the oxide core will expand more than the Zircaloy cladding during severe reactor accidents producing cladding strains in the range of one to two percent. Experimentally, 7 to 10 percent strain is required to rupture irradiated Zircaloy tubing indicating that the cladding should not fail during the reactor transients considered. However, localized areas of the cladding may experience damage during fabrication, loss of ductility or strain concentrations sufficient to crack the cladding. There is no evidence to indicate that the cladding will be pulverized into small enough pieces to accelerate a metal-water reaction nor to modify the analytical models used to evaluate the core conditions during the accidents considered. Pulsed irradiation type experiments on fuel specimens simulating the conditions reviewed would be desirable to evaluate the transient material and mechanical properties of the fuel elements. (auth)

2141 HW-59446
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
PIPING COMPONENTS FOR ORGANIC COOLANT SYSTEMS. Howard L. Floyd. Mar. 3, 1959. 7p. Contract [W-31-109-Eng-52]. OTS.

The organic compounds proposed for use as reactor coolants have a greater tendency to leak than water and are more difficult to seal. A development program was established to evaluate the types of closures required to produce a leak-tight system. Two proposed coolant compounds, monoisopropylbiphenyl and the eutectic mixture of 55% ortho terphenyl, 25% biphenyl, and 20% meta terphenyl were used. Results of the evaluation are presented. (W.L.H.)

2142 IDO-16567
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
PROPOSED 60 MW OPERATION OF MTR. J. H. Rainwater, ed. Feb. 16, 1959. 64p. Contract AT(10-1)-205. OTS.

A report has been prepared to determine the modifications required to permit operation of MTR at 60 Mw. Since recent hydraulic tests have shown the present fuel elements unsuitable for 60 Mw operation from a flow distribution and strength standpoint, it was necessary to use a modified fuel element as the basis for this study. Sufficient hydraulic studies have been made to determine the feasibility of the proposed fuel element; however, further tests must be performed before the final specifications can be determined. The higher power level is achieved by raising the pressure on the reactor tank, increasing the flow rate, improving the flow distribution in the fuel element, and increasing the capacity of the coolant system. These modifications will result in heat transfer conditions which are improved over the present conditions at 40 Mw. (auth)

2143 NAA-SR-Memo-2598
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
MAXIMUM THERMAL STRESSES OR STRAINS INDUCED IN THE OMR CORE VESSEL BY COOLANT TEMPERATURE TRANSIENTS. Charles O. Peinado. Apr. 9, 1958. 30p. OTS.

Studies were made to determine the equations required for analysis of the maximum thermal stresses or strains induced in the OMR Core Vessel by coolant temperature transients. A parameter study was also made of these equations applicable to the present core vessel design. (W.L.H.)

2144 NAA-SR-Memo-3317
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
LOW BOILERS IN OMRE COOLANT. R. A. Baxter. Dec. 31, 1958. 8p. OTS.

Studies of the effect of low boilers (components more volatile than diphenyl) on the OMRE coolant heat transfer characteristics are presented. The rate of formation and concentration of the low boiling components in the coolant were also investigated. (W.L.H.)

2145 NAA-SR-Memo-3318
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
RELIABILITY TEST OF PRESSURE RELIEF DEVICES FOR ORGANIC FLUIDS. A. N. Gallegos and S. C. Spencer. Feb. 4, 1959. 11p. OTS.

Performance characteristics of commercially available pressure relief devices in liquid and vapor Santowax R, were determined. The standard relief valve was not suitable for organic service because the spring was exposed to the organic, thereby causing fouling which prevented proper valve action. The bellows-protected valve operated satisfactorily and is recommended for OMR Piqua. Standard Monel rupture discs were tested at 650°F and failed prematurely. Rupture discs of Inconel metal were tested and performed satisfactorily and are recommended for OMR Piqua. (W.L.H.)

2146 NAA-SR-Memo-3502-A
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
NUCLEAR ANALYSIS OF THE CIRCULAR HIGH BURNUP ELEMENT TO BE TESTED IN THE OMRE. E. Specter. Feb. 20, 1959. 5p. OTS.

The enrichment of the center section of the circular high burnup element to be tested in the OMRE was computed. (W.L.H.)

2147 NAA-SR-Memo-3671
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
CALIBRATION OF OMRE FUEL-ELEMENT SURFACE THERMOCOUPLE ASSEMBLY. S. Sudar. Mar. 12, 1959. 22p. OTS.

Studies were made to determine the actual surface temperature of OMRE fuel elements if the thermocouple were not present. Chromel-alumel thermocouples are being attached to the fuel plate cladding of Type 304 stainless steel. These wires are in contact with the coolant stream. Heat transfer from the thermocouple junction, by conduction along the lead-wires and by forced convection to the coolant, produces a lowering of the surface temperature in the region of the junction which results in an error in surface temperature measurement. (W.L.H.)

2148 NAA-SR-Memo-3746
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
GASES FROM OMRE PURIFICATION SYSTEM (RUN 40-10). H. M. Gilroy and D. N. Day. Apr. 24, 1959. 14p. OTS.

Studies were performed to determine the composition of gases discharged from the OMRE purification system at various intervals during run 40-10. Also investigated was the possible correlation of purification off-gas composition with such variables as % High Boiler Residue (HBR) in coolant, reactor power level, temperature of coolant in main loop, % HBR in still bottoms, and time after the start of flashing. Results of run 40-10 showed an increase in N_2 and a decrease in decomposition gases. The gas composition did not vary uniformly with HBR concentration. There was no significant change in gas composition with flashing time. No correlation was found between the purification off-gas composition and reactor power level or main loop temperature. (W.L.H.)

2149 NAA-SR-Memo-3982
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
PRECISION ORGANIC LEVEL GAUGE. R. J. Tuttle. June 9, 1959. 6p. OTS.

The reactivity worth of the upper reflector in the OMR critical assembly must be determined experimentally. For this, it is necessary to have an accurate measure of the moderator level. The accuracy desired is ±0.010 inch over a range of 19 inches. A remotely operated level gage was developed for this purpose. The accuracy obtained is ±0.005 inch. (W.L.H.)

2150 NAA-SR-Memo-4007
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
PARAMETER STUDY OF THE DOSE RATES ON OMR SYSTEM PIPING. P. J. Legendre. June 15, 1959. 27p. OTS.

The dose rate from organic coolant piping per unit concentration of specific radioisotopes in organic coolants is determined. The dose rate per unit concentration (r/hr-ppm, or r/hr-μc/cc) at the surface of organic coolant piping is plotted as a function of nominal pipe diameter (1 to 30 inches) and pipe thickness ($^1/_8$ to $^5/_8$ inch) for each of the twenty radioisotopes predominant in OMR Systems. (W.L.H.)

2151 NAA-SR-Memo-4286
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
DESCRIPTION OF THE ADVANCED OMR HEAT TRANSFER LOOP. D. A. Huber and M. B. Bagley. Aug. 24, 1959. 22p. OTS.

The design of a forced-circulation organic heat transfer system is discussed. The system is designed to operate with bulk temperature as high as 750°F and is provided with automatic instrumentation and control to allow continuous operation for extended periods of time without attendance. The method for determining the long term fouling tendencies of organic coolants as a function of heat transfer surface temperature and coolant velocity past the heat transfer surface is discussed. (W.L.H.)

2152 RDB(W)-1016
Gt. Brit. Windscale Works, Sellafield, Cumb., England.
SOME MEASUREMENTS ON THE NEUTRON ATTENUATION IN THE BPP SHIELD. F. M. Leslie. Jan. 28, 1952. 4p.

Results of measurements on the neutron shielding of BPP are given. The experiments were carried out using the ionization chamber hole in the D-void. The D-void chamber hole was chosen by reason of its large diameter. The attenuation over the thermal shield was obtained by fixing a foil on the D-void concrete plug tip and by lowering a foil through one of the roof inspection holes into the space between the pile discharge face and the thermal shield. Experiments were made at 0.5, 20, and 200 kw. (W.D.M.)

2153 SPM-257
[France. Commissariat à l'Énergie Atomique, Paris].
EVOLUTION LENTE DE LA REACTIVITE DANS UN REACTEUR MODERE A LA GLUCINE OU AU BERYLLIUM, A LA SUITE DE LA FORMATION DE Li^6 ET DE He^3. (Slow Evolution of the Reactivity of a Beryllium Oxide or Beryllium Moderated Reactor as a Consequence of the Formation of Li^6 or He^3). J. Horowitz. Apr. 30, 1957. 6p.

In a beryllium oxide or beryllium moderated reactor, the reaction $n + Be^9 \rightarrow He^4 + He^6$ is produced by fast neutrons. The He^6 is transformed almost instantaneously by beta activity into Li^6. The thermal neutron capture by Li^6 produces He^4 and H^3. The tritium decays into He^3. The loss of reactivity caused by Li^6 and He^3 is calculated on the assumption that the two isotopes do not escape from the reactor. The equations for the reactivity loss are derived and evaluated numerically for a given case. The results show that for a natural uranium power reactor, the reactivity change caused by Li^6 and He^3 is of great importance is extended operation. (J.S.R.)

2154 SRIA-10
Stanford Research Inst. Poulter Labs., Menlo Park, Calif.
CONTAINMENT OF FRAGMENTS FROM RUNAWAY REACTOR. Summary Progress Report [for] November 1, 1958 to April 30, 1959. G. B. Huber and N. R. Zabel. June 8, 1959. 86p. SRI Project No. GU-2164. Contract AT(04-3)-115, Project No. 2. OTS.

Small-scale simulation of runaway reactor power bursts can be accomplished with chemical energy sources, such as explosives. Pyrotechnics, consisting of mixtures of oxidants and metal fuels, constitute useful auxiliary sources, providing lower energy release rate and less gas evolution than explosives. Energy sources employing high explosives alone and high explosive-pyrotechnic mixtures were developed to simulate reactor excursions with periods in the 1 to 5-millisecond range. The simulated energy releases are scaled in rate, duration, and amount. Simple, scaled, reactor test models were designed and assembled to evaluate the effects of simulated reactor excursions. A model consists of a cylindrical steel vessel filled with water, a concrete shield, and a steel step plug for the assembly. Six models were tested, five of them with excursion power bursts. All concrete shields broke up. The shield thickness represented 8 feet of concrete in an actual reactor. Maximum excursion simulated had a 760 lb TNT equivalent and a 1 millisecond period. Minimum energy release had a 49 lb TNT equivalent. Two additional series of penetration experiments were carried out. As anticipated, size of hanging target plate for which edges no longer affect projectile energy requirements for penetration appears to be proportional to plate thickness. The second series, with inch-thick targets, indicated that abnormal grain structure, due to slightly excessive heat treatment of the steel in the targets, can appreciably reduce the resistance to penetration. (auth)

2155 TPI-51
Atomic Energy of Canada Ltd., Chalk River, Ont.
THE POISONING OF NRX PILE. W. H. Watson. Oct. 1948. Reprinted with Minor Revisions September 1959. 30p. (AECL-732). AECL.

Experimental methods used to study the poisoning of the NRX reactor are described. The operation of the reactor in relation to these methods is reviewed for the period February to September 1948. The poisons considered are Xe and Sm. (auth)

2156
THE TEMPERATURE PATTERN IN DOUBLE FLOW-THROUGH REACTOR COOLANT CHANNELS. H. D. Baehr and W. Strewe (Universitat, Berlin). Atomkernenergie 4, 398-402(1959) Oct. (In German)

In the second part, two ways of directing the cooling medium through the annuli are compared: parallel flow and reverse flow. The example of a reactor cooled by superheated steam is presented. (auth)

2157
APPROXIMATE CALCULATION OF THE SURFACE LOSS IN REACTORS. M. Ledinegg. Atomkernenergie 4, 351-6 (1959) Sept. (In German)

The extent to which a calculation of the neutron leakage, based upon the simple diffusion law, agrees with the more exact method of the two-group theory is investigated. It is found, that, in spite of a considerably simplified computation, the agreement is a satisfying one. (auth)

2158
AN APPLICATION OF DIMENSIONAL ANALYSIS IN THE DETERMINATION OF THE MAXIMUM TEMPERATURE DIFFERENCE IN CYLINDRICAL FUEL ELEMENTS. W. Kattwinkel (Kernenergieabteilung von L. and C. Steinmüller, Gummersbach/Rhld., Ger.). Atomkernenergie 4, 356-9(1959) Sept. (In German)

In general, maximum thermal stress in a body is proportional to the maximum temperature difference. This temperature difference is derived for the steady state—during heating the differences are smaller—by means of dimensional analysis. It follows that $\Delta U = w_0/(\lambda \varkappa^2)g(\varkappa R)$. The result is discussed. (auth)

2159

THE TEMPERATURE DISTRIBUTION IN A BARE FINITE CYLINDER WITH TIME DEPENDENT SOURCE DISTRIBUTION. APPLICATION TO A FUEL ELEMENT OF LONG LENGTH. M. Angelopoulos (Public Power Corp., London). Atomkernenergie 4, 359-63(1959) Sept. (In German)

The solution of the partial differential equation of heat conduction in a finite bare cylinder with time dependent internal heat generation is considered. The solution is obtained by means of the appropriate integral transforms, under the assumption that the coolant temperature is a time independent function of z. The case of a very long cylinder is discussed, with special reference to that of a long fuel element. In this case, an approximate expression is derived for the temperature distribution. (auth)

2160

THERMAL STRESSES IN THE STEEL WALLS OF REACTOR PRESSURE VESSELS UNDER NEUTRON BOMBARDMENT IN PARTIAL COOLING. Günther Grass (Mitteilung aus dem Forschungsinstitut der Mannesmann AG, Ger.). Atomkernenergie 4, 364-8(1959) Sept. (In German)

By absorption of neutrons (neutron capture) in steel walls of reactor containers, energy losses of neutrons may be transformed into useless heat which is removed by heat conduction to the cooled inside surface. The implied temperature gradient sometimes produces thermal tensions in the steel wall. A formula is given to calculate the amount of temperature gradient and thermal tensions in neutron bombarded steel walls as a function of number and energy of neutrons, material qualities, and container dimensions. The formula is evaluated. The results are presented as tabular data and plotted graphically. The accuracy of the formula is estimated to be about 10% because transversal contraction was neglected to obtain a formula sufficiently simple. (auth)

2161

A METHOD FOR THE CALCULATION OF THE THERMAL UTILIZATION IN HETEROGENEOUS REACTORS. A. Kirchenmayer (Technischen Hochschule, Stuttgart). Atomkernenergie 4, 395-7(1959) Oct. (In German)

A method which simplifies the calculation of the thermal utilization in a heterogeneous reactor is given. It is shown, that the absorption and the increase of the neutron flux in a hollow cylinder can be simply expressed by the neutron currents crossing the envelopes and by two groups of Bessel functions. Approximate formulas are also given. In this method only two groups of Bessel functions will appear in the expression for thermal utilization, the absorptions of the single media are obtained directly, and the derivation is shorter. For other geometries the situation is similar. (auth)

2162

THE THERMAL UTILIZATION OF HETEROGENEOUS REACTORS IN THE FRAMEWORK OF THE TWO-GROUP THEORY. A. Kirchenmayer (Technischen Hochschule, Stuttgart). Atomkernenergie 4, 397-8(1959) Oct. (In German)

The thermal utilization f is derived for the cylindrical cell in which the slowing down is taking place only in the moderator, whereby the distribution of the fast and thermal neutrons is assumed according to the two-group theory. The result is given as a function of the usual thermal utilization f_0, which is given by the assumption that the slowing down density is the same in all points of the moderator. The small difference between f and f_0, which is of the order 10^{-4}, confirms the former assumption and gives the exactness of this assumption, at least according to the two-group theory. (auth)

2163

THE TEMPERATURE PATTERN IN DOUBLE FLOW-THROUGH REACTOR COOLANT CHANNELS. Hans Dieter Baehr and Wolfgang Strewe (Technischen Universität, Berlin). Atomkernenergie 4, 345-50(1959) Sept. (In German)

By a suitable choice of the coolant flow directions and by dividing the cooling channel into two concentric annuli, it is possible to achieve high coolant exit temperatures in a reactor with pressure tubes, which are kept relatively cold. The temperatures of the cooling medium and the surface temperatures of the fuel elements are calculated. (auth)

2164

A GAS-COOLED REACTOR OF HIGH THERMAL EFFICIENCY. W. Spillmann. Atomkernenergie 4, 416(1959) Oct. (In German)

Winterberg (NSA 13-5972; Atomkernenergie 4, 2-6(1959)) proposed a cyclic process in which an isothermal expansion occurred with heat input to improve the efficiency of gas-cooled reactors with gas turbines. The entropy difference over which the process takes place is used for the calculation of the efficiency. The neglect of the dynamic constituents of the process work causes the proposed process to be unpractical. (J.S.R.)

2165

REPLY TO THE PRECEDING REMARK OF MR. W. Spillmann. F. Winterberg (Case Inst. of Tech., Cleveland). Atomkernenergie 4, 416-18(1959) Oct. (In German)

The addition of dynamic constituents for the isothermal change of state in the calculation of the efficiency of a cyclic process in gas-cooled reactors is not correct, and the conclusions drawn from this assumption are worthless. (J.S.R.)

2166

WAYS OF ECONOMIZING ON STEEL IN REACTORS. A. N. Komarovskii. Atomnaya Energ. 7, 205-14(1959) Sept. (In Russian)

Data are presented which indicate that the use of steel in reactor shielding may be reduced by replacing it with concrete. Capillary cracks formed in concrete do not effect its shielding properties. The Soviet Boiling Water Reactor now under construction, designed for a thermal power of 300 Mev, will have a reinforced concrete vessel which will serve as both biological and blast shields. The vessel is steel plated inside to provide leak tightness and is designed to withstand an internal pressure of 3.5 atm. Specification and calculations are included. (R.V.J.)

2167

THE γ-RAY SPECTRUM OF THE IRT REACTOR. L. V. Groshev and A. M. Demidov. Atomnaya Energ. 7, 257-8 (1959) Sept. (In Russian)

A magnetic spectrometer was used for measuring the gamma spectrum emitted through one of the horizontal reactor channels. The measured and calculated spectra are presented. The γ rays pass through ~10 cm of graphite, causing sharp drop in the spectrum at <0.7 Mev. The IRT is an aluminum container reactor working with enriched uranium fuel and ordinary water moderator; consequently, γ lines can be easily separated from neutrons captured in aluminum ($E\gamma = 7.72$ Mev), carbon ($E\gamma = 4.95$ Mev), hydrogen ($E\gamma = 2.23$ Mev), and γ line of the Al^{28} β decay at 1.78 Mev. The unresolved section of the spectrum is from (n,γ) reactions in U^{238} and U^{235}. The relative value $\int \nu(E_\gamma)\, E_\gamma dE_\gamma$ are tabulated for various sections of the spectrum. (R.V.J.)

2168

MEASUREMENT OF LAPLACIANS BY THE METHOD OF PROGRESSIVE REPLACEMENT. Bull. inform. sci. et tech. (Paris) No. 31, 30-1(1959) July-Aug. (In French)

The replacement method and its applications are briefly discussed. The method consists of placing a sample of the lattice to be measured at the center of a critical assembly and deducing its Laplacian from the reactivity variation or the critical volume. (T.R.H.)

2169

FAST EXPONENTIAL EXPERIMENT PRELIMINARY RESULTS. Bull. inform. sci. et tech. (Paris) No. 31, 78-84 (1959) July-Aug. (In French)

Preliminary results of a fast exponential experiment in the diffusion column of EL2 at Saclay in September 1957 are given and discussed. It consisted of studying neutron propagation from a plane source in natural U. A divergence was found in relaxation lengths measured with detectors with and without a threshold. Some multigroup calculations based on diffusion theory were made which did not give the asymptotic spectrum and diffusion lengths characteristic of propagation of this spectrum in natural U. Modifications based on these findings are discussed. (T.R.H.)

2170

THE CHEMICAL INDUSTRY—A NUCLEAR FUTURE? PART II. REACTOR PHYSICS. W. R. Tomlinson, Jr. (The Johns Hopkins Univ., Bethesda, Md.). Ind. Eng. Chem. 51, 1339-44(1959) Nov.

A review of progress and applications of nuclear reactors in the chemical industry is given. A discussion of reactor statistics including design of cores, moderators, reflectors, and shielding is presented. In addition a suggested reference list in this field is included. (J.R.D.)

2171

FUEL ELEMENTS, FUEL ELEMENT CLADDING AND REACTOR CONSTRUCTION MATERIALS. I. FUEL ELEMENTS AND CLADDING. Jaroslav Pluhař and Jaroslav Vrtěl (SVUMT, Prague). Jaderná energie 5, 296-303(1959). (In Czech.)

The present state and future development of reactor fuels and fuel elements, including cladding materials and design characteristics, are estimated from the material point of view. (auth)

2172

THE POWER OF A HEAVY WATER REACTOR DURING AN EMERGENCY SHUTDOWN. I. M. El-Ibiary (Cairo Univ.). Nuclear Energy Engr. 13, 545-9(1959) Nov.

To evaluate the shutdown reactivity present in the JEEP reactor when a scram is effected, the fast decay of power was measured and compared with the solution obtained by an electronic reactor simulator for a step function of negative reactivity, using three groups and a source term to represent the mechanism of delayed neutron production. The experimental curve was compared with the solutions obtained by the simulator for different values of negative reactivity and from the best fit the value of the shutdown reactivity was determined. An approximate analytical solution was also obtained using one group of delayed neutrons and a source term. Such a solution could be used over a limited interval of time and, within this interval, could be relied upon to indicate the value of the shutdown reactivity. (auth)

2173

THE GEC CROSS-FLOW FUEL ELEMENT. M. C. Hartnell-Beavis (General Electric Co., Ltd., London). Nuclear Power 4, No. 43, 106-8(1959) Nov.

The new fuel-element design which was produced by the GEC, overcomes most of the difficulties associated with geometry. A representative design of the element is shown. The UO_2 fuel pellets are canned in 0.010 in. 18/8 stainless steel. The dished end caps are heliarc welded onto an oval can and protected from excessive temperatures during operation by porous magnesia inserts. The design is intended for use in land-based and marine advanced gas-cooled reactors of 30 to 100 Mw. (W.D.M.)

2174

INSTRUMENTATION AND SUPERVISION OF NUCLEAR REACTORS. P. Bonnaure (Centre d'Études Nucléaires, Saclay, France). Onde élec. 38, 575-82(1958) Aug.-Sept. (In French)

A concise description is given of the measuring and control equipment developed by C.E.A. and industry to ensure the proper supervision of thermo-nuclear reactors. The apparatus for the measurement of the power output and the activity, as well as the detectors of faults in the sheaths, are examined in greater detail. (auth)

2175

NEW TECHNIQUES IN THE CONSTRUCTION OF SIMULATORS FOR NUCLEAR POWER STATIONS. P. Braffort and C. Caillet (Centre d'Études Nucléaires, Saclay, France). Onde élec. 38, 583-91(1958) Aug.-Sept. (In French)

The specialized reviews have published a number of articles on the analog calculations for reactors at nuclear power stations. Starting from original examples the difficulties which are encountered when attempting the simulation of equipment are discussed. This equipment includes: homogeneous reactors, push-pull, nuclear and thermonuclear power stations. (auth)

2176

CONTROL PROCESS FOR A REACTOR BELOW CRITICAL LEVEL. J. Lacour and V. Raievski (Centre d'Études Nucléaires, Saclay, France). Onde élec. 38, 592-9(1958) Aug.-Sept. (In French)

The knowlege of the subcritical state of a reactor in the course of starting up makes it possible to avoid passing too quickly through the critical state. The problem arises every time the pile is put into action again following, for example, an appreciable modification in the fuel charge or a stop during a run at high power. The method described provides a means of knowing at each instant the antireactivity value of the pile by means of a direct-reading instrument mounted on the control board. This result is obtained by oscillating reactivity at fixed frequency and reading on a phasemeter the phasing of the neutron density. Theory shows, and experiments confirm that for a given frequency the phasing depends only on the lifetime of the prompt neutrons, the characteristics of the delayed neutrons, and the antireactivity of the reactor. (auth)

2177

THERMAL STRESSES IN REACTOR SHELLS DUE TO THERMAL NEUTRON IRRADIATION. II. M. J. Hillier (Enfield Technical Coll., Enfield, Middx., Eng.). Reactor Sci. 10, 104-10(1959) Sept.

Assuming that the γ-ray source in a flat plate may be expressed in a one-dimensional representation by the sum of exponential terms, the rate of heat production, peak plate temperature, and stress are calculated by methods based on a thermal neutron distribution of the form $\phi_n \exp(-Kx)$. The results are presented in the form of dimensionless curves so as to apply to a wide range of materials. (auth)

2178

ACCURACY AND SCOPE OF VARIATIONAL AND DIFFER-

ENCE SOLUTIONS OF THE DIFFUSION EQUATIONS OF REACTOR THEORY. R. T. Ackroyd and M. A. Perks (United Kingdom Atomic Energy Authority, Risley, Lancs, Eng.). Reactor Sci. 10, 141-6(1959) Sept.

A comparison is made of the accuracy of variational and difference solutions of the one-group diffusion equation. For reactors with a few regions there is little practical difference in the solutions for the fluxes and laplacians as given by the two methods. The variational method can easily be used with a hand machine, and when programmed for a digital computer it is several times faster than the difference method. The authors experience with a medium size computor is that the variational method is the more accurate for reactors with many regions. (auth)

2179

FLUX, REACTIVITY, STEAM VOID, AND STEAM-WATER INTER-LAYER NOISE SPECTRUMS IN THE EBWR. James A. De Shong Jr. (Institute for Atomenergi, Lillestrøm, Norway). Reactor Sci. 10, 147-56(1959) Sept.

The reactor flux noise was recorded and Fourier analyzed. It showed a resonance peak in the energy-frequency spectrum and was not a 'white' noise. Such was also the case for the reactivity spectrum, obtained by operating on the flux spectrum with a measured power transfer function. A transfer function relating the power (N) to a steam-water inter-layer input was calculated by using the reactor dynamic model. The inter-layer spectrum obtained by operating on the flux spectrum with this function was 'white' over a frequency range of 30 to 1, and probably is the result of random variation of the steam generation rate due to discrete steam bubbles entering the steam space. Such noise spectrums can be employed for gross stability investigations if a fair knowledge of the dynamic model is in hand. (auth)

2180

THE COMPUTATION OF THE FERMI AGE IN A HETEROGENEOUS REACTOR BY THE MONTE CARLO METHOD. Willy Matthes and Tasso Springer (Technische Hochschule, Munich). Reactor Sci. 10, 158-9(1959) Sept.

The results of Monte Carlo computations on the Fermi age $T = r^{-3/4}$ in a lattice of cylindrical uranium rods in light water are given and compared to the experimental results obtained by Barkov and Brookhaven and Oak Ridge laboratories. (C.J.G.)

2181

PROCEEDINGS OF THE SECOND UNITED NATIONS INTERNATIONAL CONFERENCE ON THE PEACEFUL USES OF ATOMIC ENERGY, HELD IN GENEVA, 1 SEPTEMBER—13 SEPTEMBER 1958. VOLUME 13. REACTOR PHYSICS AND ECONOMICS. Geneva, United Nations, 1958. 642p. $18.50.

Papers are presented from sessions B-14b on economics of nuclear power, B-15 on fuels and fuel cycles, and B-19 neutron distribution and shielding. The key aspects of reactor economics are discussed, both with respect to general problems such as the re-enrichment of depleted fuel and with respect to various reactor systems. Frequent examination of existing reactors and their specific problems provides a very useful comparison with the more abstract theoretical papers. (W.D.M.)

2182

IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. John Kenneth Jobbins and James Leslie Kearney (to United Kingdom Atomic Energy Authority). British Patent 821,655. Oct. 14, 1959.

A removable shield-plug arrangement for reactor refuelling tubes is described which is equipped for control rod manipulation. (T.R.H.)

2183

IMPROVEMENTS IN OR RELATING TO HEAT TRANSFER SYSTEMS IN NUCLEAR REACTOR FUEL ELEMENTS. William Bateman Hall (to United Kingdom Atomic Energy Authority). British Patent 821,861. Oct. 14, 1959.

A fuel element cooling fin design is offered. A transverse circular or close-pitched helical fin on a tubular or rod-shaped element is cut into an even number of segments per convolution. These segments are bent alternately up and down with respect to the rod axis so that segments registering longitudinally are all bent in one direction and adjacent segments are bent in the other. (T.R.H.)

2184

SHIELDS FOR NUCLEAR REACTORS. Ivo Joseph Lockyer (to Morgan Crucible Co., Ltd.). British Patent 821,915. Oct. 14, 1959.

The preparation of a carbon—graphite—boron shielding material is described. In one example 50 parts graphite dust, 25 parts petroleum coke, 20 parts borax, and 30 parts tar or pitch binder are combined, tamped, and heat treated at 1000°C. The capture cross section is 2.52 cm^2. Alternatively, a petroleum coke and binder mix is tamped and heat treated at 1200°C, and then dipped in molten borax under air pressure to produce a material with a capture cross section of 0.477 cm^2.

2185

IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. (to United Kingdom Atomic Energy Authority). British Patent 821,931. Oct. 14, 1959.

A reactor shut-down arrangement is described. A neutron absorbing rod is held electromagnetically above the reactor. The rod is forced hydraulically into the reactor when an abnormal condition develops. The tube and rod are stepped internally to provide radiation traps to prevent leakage. (T.R.H.)

Research Reactors

2186 AECU-4389

Internuclear Co., Inc., Clayton, Mo.

AETR NUCLEAR MOCKUP DESIGN. B. H. Leonard, P. C. Bertelson, M. J. Kornfeld, and E. E. Wade. Oct. 6, 1959. 75p. Contract AT(11-1)-688. (INTERNUC-48). OTS.

The Advanced Engineering Test Reactor (AETR) nuclear mockup is designed to be a flexible, inexpensive developmental facility which duplicates the reactor portion of the AETR and which would be used to verify the operation of reactor controls. The mockup would also furnish measurements of temperature and void coefficients, flux shapes, and critical mass, and facilitate a reliable AETR design in a minimum time, and with minimum development cost. For even greater usefulness, the mockup is also designed for use in conjunction with an operating AETR to check the reactivity of experiments and fuel assemblies, and for other annular core reactor development purposes. In these respects, the mockup design embodies the concepts for a very low power nuclear auxiliary outlined in an earlier report. Detail design was limited to the reactor assembly and control systems and it is assumed that a simple building with supporting facilities may be readily supplied by private industry or the AEC. Results of negotiations with potential vendors and fabricators, a description of the facility components, and design drawings suitable for contractor use are presented. Preliminary quotations from fabricators and suppliers indicate that the facility can be in operation within an eight month period at a total cost not exceeding \$250,000.00 exclusive of U^{235} fuel and heavy water. (auth)

2187 CF-57-9-48

Oak Ridge National Lab., Tenn.

DESIGN AND EXPERIMENTAL EVALUATION OF ELECTROMAGNETS FOR RESEARCH REACTORS. C. Michelson. Sept. 6, 1957. Changed from OFFICIAL USE ONLY June 18, 1959. 99p. Contract [W-7405-eng-26]. OTS.

This report reviews the basic principles of electromagnet design, with special emphasis on the factors which affect release time, and presents an experimental evaluation of the performance of solid and slotted pole electromagnets used in research type reactors. The potential hazards of improper magnetic circuit arrangements are pointed out, and the problem of performance specification and evaluation is reviewed. A practical approach to magnet design optimization is outlined and a typical example worked out (auth)

2188 IEA-1

São Paulo, Brazil. Universidade. Instituto de Energia Atômica.

REATOR DE PESQUISAS. (Research Reactor). [1958]. 25p.

The 5 Mw swimming pool reactor of the Instituto de Energia Atômica of Brazil is described. The reactor is cooled and moderated by water and uses 20% enriched uranium fuel, clad with aluminum. The pneumatic irradiation system and the reactor characteristics are discussed. The critical experiments made with the reactor are briefly reviewed, and the other research made is outlined. (J.S.R.)

2189

PROSERPINE. Bull. inform. sci. et tech. (Paris) No. 31, 49-53(1959) July-Aug. (In French)

Proserpine reactor is briefly described and some critical experiments reported. The experiments include critical mass determination, absolute calibration of reactivity, and temperature coefficient. (T.R.H.)

2190

EL 2 AND EL 3 REACTORS. Bull. inform. sci. et tech. (Paris) No. 31, 118-27(1959) July-Aug. (In French)

Experiments with the EL 2 and EL 3 reactors are described. The effects of experimental arrangements on pile reactivity and heat exchange between pile and experiment were studied. Other studies are discussed in sections entitled: pile physics, measurement of flux coefficients of the fuel elements, heating of materials in the pile, thermal measurements in the pile, and reactivity calibration of the compensation rods in EL 3. (T.R.H.)

Power Reactors

2191 AECU-4384

Power Reactor Development Co., Detroit.

FIRST QUARTERLY TECHNICAL REPORT OF POWER REACTOR DEVELOPMENT COMPANY. Mar. 6, 1959. 60p. OTS.

The major technical developments relevant to the subject matter which have taken place with respect to the Enrico Fermi Atomic Power Plant since Aug. 1957 are summarized. The containment building has been erected and the reactor vessel and a considerable amount of equipment have been installed. The ZPR-III critical experiments concerning core composition and geometry and operational and control data have been substantially completed with highly satisfactory results, and the remainder of the experiments are to be completed by the end of 1959. A great variety of data has and is being collected with respect to environmental phenomena. A new technical description of the power plant was prepared (APDA-124) and is included as an appendix. Research areas covered in some detail include stability of fast reactors, temperature and power coefficients, oscillator tests, meltdown, containment, site and environment, and analysis of maximum credible accident. (W.D.M.)

2192 AECU-4415

Duquesne Light Co., Shippingport, Penna.

CONTROL ROD POSITIONS FOR CRITICALITY. SECTION I—2790.1 EFPH. SIXTH PERFORMANCE. Test Results DL-S-149 (T-550130). First Issue, Sept. 29, 1959. 21p. OTS.

The critical rod bank positions and rod bank worths were determined at 2790.1 EFPH for four different control rod configurations at a coolant temperature and pressure of 130°F and 400 psig. (J.E.D.)

2193 AECU-4460

Duquesne Light Co., Shippingport, Penna.

NON-DESTRUCTIVE TESTING OF STAINLESS-CARBON STEEL WELDS. SECTION I. Test Results DL-S-241 (T-641300). First Issue, Oct. 15, 1959. 4p. OTS.

Determination was made of the thermal cycling effect on the stainless steel welds in the reactor plant. Results indicated that the transition joint at the discharge end of the 1A main cooling loop drain valve showed evidence of a defect when checked with dye. (auth)

2194 AECU-4461

Duquesne Light Co., Shippingport, Penna.

CONTROL ROD POSITIONS FOR CRITICALITY. SECTION II. SEVENTH PERFORMANCE, CORE I, SEED I. Test Results DL-S-149 (T-550130). First Issue, Oct. 22, 1959. 20p. OTS.

Determination of the critical bank heights and bank worths for various rod configurations at normal reactor plant operating temperature and pressure is reported. (auth)

2195 AECU-4463

Duquesne Light Co., Shippingport, Penna.

COMPARISON OF FEDAL MONITOR READINGS WITH RADIOCHEMICAL SAMPLE DATA. SECTION I. SECOND PERFORMANCE, CORE I, SEED I. Test Results DL-S-229 (T-641305). First Issue, Oct. 22, 1959. 18p. OTS.

A comparison is made of the specific isotopic fission product activities with those of the neutron emitters which were monitored by the FEDAL system. Further information on the source of the unusual activity observed in the PWR reactor coolant is reported. (auth)

2196 AECU-4464

Duquesne Light Co., Shippingport, Penna.

XENON TRANSIENT TESTS XENON BURNOUT. SECTION III. SECOND PERFORMANCE, CORE I, SEED I. Test Results DL-S-156 (T-612081). First Issue, Oct. 26, 1959. 22p. OTS.

The control rod drive speed necessary for satisfactory reactor control during the burnout of maximum xenon was determined to be approximately 48 in. per hour. The xenon had no effect on the power distribution in the core during burnout period. (auth)

2197 AECU-4466

Duquesne Light Co., Shippingport, Penna.

CHARGING AND DISCHARGING OF DEMINERALIZER RESINS. SECTION III. FIRST PERFORMANCE. CORE I-SEED I. Test Results DL-S-180 (T-612085). First Issue, Oct. 27, 1959. 5p. OTS.

The resin in No. 1 canal water system demineralizer was discharged into the 1B resin storage tank, radioactive waste disposal system, without difficulty. The demineralizer was completely flushed in 7 min using 1800 gal of water. (auth)

2198 ANL-5862
Argonne National Lab., Lemont, Ill. and Atomic Energy of Canada Ltd., Chalk River, Ont.
FUEL DEFECT TEST—BORAX-IV. R. F. S. Robertson and V. C. Hall, Jr. Oct. 1959. 47p. Contract W-31-109-eng-38. OTS.

On March 11 and 12, 1958, the BORAX-IV reactor was operated at a power of 2.4 Mw, even though a large number of the fuel elements contained defects through the cladding. Subsequent investigation showed that 22 of the fuel elements in the reactor contained one or more ruptured rods. During operation, radiation fields in the vicinity of the turbine and condenser were high, but on shutdown all radiation levels decayed rapidly with a 30-min half life and after 12 hr all parts of the turbine and condenser showed only normal radiation levels of a few mr/hr. The effluent gases, the reactor steam, the condensate, and the reactor water were sampled during steady operation and analyzed for fission product gases and other fission products. An analysis of the data was made using information obtained from tests of defect ceramic fuel in EBWR, and an attempt was made to predict contamination levels throughout the system. Predicted levels agreed qualitatively with those found and in general the method led to high results. On the basis of these experiments it can be predicted that a boiling reactor, fueled with ceramic fuel, can operate for long periods of time with many defects through the cladding. Under these conditions, although activity levels may be high during operation, no significant amount of long-lived contamination, other than fission gases which have stable daughters, will be released to the reactor surroundings. (auth)

2199 APAE-45
Alco Products, Inc., Schenectady, N. Y.
HAZARDS AND MISSILE SURVEY OF NUCLEAR REACTOR VAPOR CONTAINMENT FOR SM-2. H. F. Van Kessel. 1958. 171p. Contract DA-44-009-ENG-3506.

A study is presented of containment of radioactive materials after escape from the normal boundaries of the primary system through accidental release of energy which partially or totally destroyed these boundaries. The maximum credible accident is defined. Items considered in the survey include pressure-volume-time-temperature relations of the vapor container, vapor container configuration and location, and container loadings. Several specific conclusions are listed and an indicated approach to the missile problem is outlined. (J.R.D.)

2200 BAW-1136
Babcock and Wilcox Co. Atomic Energy Div., Lynchburg, Va.
LIQUID METAL FUEL REACTOR EXPERIMENT. ANNUAL TECHNICAL REPORT. Mar. 25, 1959. Changed from OFFICIAL USE ONLY Nov. 3, 1959. 170p. Contract AT(30-1)-1940. OTS.

LMFRE-I Design: A detailed design description is given of a 5-Mw, Bi—U fueled, graphite moderated reactor. Studies of reactor hazards, reactor mathematics and physics, systems arrangements, remote maintenance, fuel chemistry, and site and building development are included. Research and Development: Corrosion loop studies designed to demonstrate the feasibility of using Croloy as a structural material are reviewed. Progress in the development of liquid metal control elements is outlined. Equipment and procedures developed for welding beryllium are described. The mechanical properties of plain and sawtooth cemented joints in graphite were determined. Preliminary feasibility studies of impregnating reactor graphite with various metals to prevent bismuth absorption are described. The preparation methods and some of the properties of $Bi-ThO_2$ slurries are given. The solubility of U in liquid Bi—U alloy is plotted as a function of temperature. The effects of fission products, Zr, Mg, and Na contamination on U solubility are also given. Techniques for decontaminating Croloy, using mercury and mercury vapor, were evaluated. Croloy bellows and valves were tested in liquid Bi; results are summarized. Standard and modified remote handling and remote viewing equipment for use in the LMFRE-I facility is described. (D.E.B.)

2201 BAW-1142
Babcock and Wilcox Co. Atomic Energy Div., Lynchburg, Va.
LIQUID METAL FUEL REACTOR EXPERIMENT. THE EFFECT OF SLURRY INHOMOGENEITY ON NUCLEAR STABILITY OF LIQUID METAL FUEL REACTORS. H. E. Zellnik, W. E. Miller, and C. E. Thomas. Jan. 29, 1959. 39p. Contract AT(30-1)-1940. OTS.

The two slurries being considered for LMFR use are thorium bismuthide, partially soluble in bismuth, and slurries insoluble in bismuth, such as ThO_2, ThC, or ThF_4. With an insoluble slurry, the slurry particles may be composed of a single solid phase, the mixed Th and U compounds being in solid solution. These questions were investigated for the one- or two-region LMFR, using either a soluble or insoluble slurry: What happens when the slurry concentration increases or decreases in the core or blanket region? Will a choice of suitable initial operating conditions and/or choice of slurry materials compensate for these variations? Results of the investigation are reported. (W.L.H.)

2202 CF-59-10-76
Oak Ridge National Lab., Tenn.
PRESSURE AND TEMPERATURE IN THE EGCR EXPERIMENTAL LOOP CELL IN CASE OF ACCIDENTAL RELEASE OF MAIN REACTOR COOLANT. M. H. Fontana. Oct. 20, 1959. 24p. OTS.

The possibility exists that a failure of the EGCR experimental loop piping in the loop equipment cell can induce a failure of the loop piping within the main pressure vessel due to overheating of the experiment and the collapsing pressure exerted by the main coolant gas. Release of the main coolant into the experimental cell would cause the pressure to rise rapidly above the structural design value of 12 psig unless a pressure relief hole were provided. Accordingly, it is intended that each experimental cell be relieved to the containment shell. A study of cell pressure was undertaken on an IBM 704. This analysis showed that rupture discs or blow-out doors providing 4.29 ft^2 flow area per cell are sufficient to keep the pressure below 12 psig if 4.67-in.-diam. orifices are inserted in the loop piping. (auth)

2203 GEAP-3082 (Rev.)
General Electric Co. Atomic Power Equipment Dept., [San Jose, Calif.].
SUMMARY AND TECHNICAL SPECIFICATIONS FOR THE DRESDEN NUCLEAR POWER STATION. J. L. Murray and D. P. Ebright. Dec. 31, 1958. Revised Feb. 3, 1959. 28p. OTS.

Part I, entitled "Summary," describes briefly the salient features of the Dresden plant, with particular emphasis on those features which promote safe operation of the plant and the protection of the public. Part II, entitled "Technical Specifications," sets forth those design, operational, and procedural provisions of the Hazards Summary Report which it is proposed shall become the technical specifications incorporated in the license for the Dresden plant pursuant to Section 50.36 of the Regulations of the Atomic Energy Commission. It is intended that these technical specifications shall constitute the limitations upon the design and operation of the Dresden plant, and upon any and all changes which may be made from time to time with respect thereto. The establishment of these specifications will eliminate the need for revision of the Hazards Summary Report and amendments thereto previously submitted to accommodate design and operational modifications made within the limits of these specifications. No deviations will be made from these specifications, and no changes will be made within the limits of these specifications which would materially affect the safety standards established by the Hazards Summary Report and amendments thereto without first obtaining the approval of the AEC for such deviations or changes. (auth)

2204 NAA-SR-2011
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
DEVELOPMENT OF THE SRE THIMBLE-TYPE CONTROL RODS, MARK I AND II. A. E. Miller. Oct. 15, 1959. 63p. Contract AT-11-1-GEN-8. OTS.

Two thimble control rods were developed for the Sodium Reactor Experiment. In the Mark I design, all components, except the easily-removed drive motor assembly, are located below the reactor shield. The Mark I is presently limited by life expectancy to the slow and infrequent motion required of a shim rod. The Mark II, designed with the traversing mechanism located above the shield, is used for the fast and frequent regulating motion. All components of the control rods are protected from the sodium coolant by 23-ft-long stainless-steel "thimbles" that extend from the reactor loading face downward through the active core. The nuclear poison elements of the control rods, formed by a series of short, hollow boron-nickel cylinders stacked on stainless-steel pull tubes, are moved vertically in a helium atmosphere by a recirculating ball-screw and nut. The clearance between the poison cylinders and the thimble wall, which permits adequate cooling of the cylinders, was determined from heat transfer experiments. Development and tests of the control rod components provided design information. Operation and life tests of prototype control rods were performed to establish their reliability under reactor temperature conditions. (auth)

2205 NAA-SR-3990
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
SODIUM REACTOR EXPERIMENT (SRE) SHIELDING EVALUATION FOR THERMAL NEUTRON STREAMING AT REACTOR VESSEL COOLANT PIPE PENETRATIONS. F. D. Anderson. Oct. 31, 1959. 56p. Contract AT-11-1-GEN-8. OTS.

The experimental program performed in the SRE auxiliary and main primary galleries was part of a program to determine the adequacy of the shielding configuration for the SRE. The work discussed in this report is concerned with analysis of neutron streaming at coolant pipe penetrations of the reactor vessel, analysis of the shielding required, testing and evaluation of recommended shielding, and measurement and correlation of neutron streaming in labyrinths with theory. The activation analysis method using zinc sheets which was developed for the program of determining thermal neutron streaming in the SRE primary galleries was proven to be versatile, accurate, and reliable. A modified form of the theoretical method of Price, Horton, and Spinney, used to determine neutron scattering through labyrinths, was found to agree favorably with the experimental results obtained from the SRE primary galleries. The theoretical attenuation method used to determine the neutron shield configuration installed in the auxiliary primary gallery was found to give an overestimate of the actual attenuation properties of this shield. The neutron shield configuration installed in the auxiliary primary gallery proved to be adequate in reducing the thermal neutron streaming flux to an acceptable level. It is concluded that both SRE primary galleries are now adequately shielded to prevent excessive neutron-induced activation of the components and equipment located therein. (auth)

2206 NAA-SR-4040
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
FUEL PROGRAMMING FOR SODIUM GRAPHITE REACTORS. T. J. Connolly. Oct. 15, 1959. 34p. Contract AT-11-1-GEN-8. OTS.

The effect of fuel programming, i.e., the scheme used for changing fuel in a core, on the reactivity and specific power of a sodium graphite reactor is discussed. Fuel programs considered include replacing fuel a core-load at a time or a radial zone at a time, replacing fuel to maintain the same average exposure of fuel elements throughout the core, and replacing and transferring fuel elements to maintain more highly exposed fuel in the center or at the periphery of the core. Flux and criticality calculations show the degree of power flattening and the concurrent decrease in effective multiplication which results from maintaining more exposed fuel toward the core center. Converse effects are shown for the case of maintaining more exposed fuel near the core periphery. The excess reactivity which must be controlled in the various programs is considered. Illustrative schedules for implementing each of these programs in an SGR are presented. (auth)

2207 NAA-SR-4206
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
INDUCTION HEATING TESTS IN THE HALLAM NUCLEAR POWER FACILITY DEVELOPMENT PROGRAM. H. W. Lohman. Nov. 15, 1959. 31p. Contract AT-11-1-GEN-8. OTS.

Induction heating tests of empty and sodium-filled stainless steel pipes clad with mild steel were conducted to determine pipe temperature variations and electrical system characteristics. Induction heating of clad stainless steel pipes operates suitably on single-phase alternating current of powerline frequency at power factor and efficiency values of 0.75, but large temperature variations along the pipe may result. The optimum thickness of cladding material was found to be approximately $^1/_8$ in. An explanation of the cause of temperature variation is proposed. (auth)

2208 NAA-SR-Memo-3415
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
CONTROL ROD SURVEY. B. L. Hoffman. Dec. 19, 1958. 15p. OTS.

A computational method to handle rod worth determinations in the Piqua core was developed. In addition, the reactivity effect of the collapse of a dry thimble in the appropriate cases was determined. The rod worth calculations indicate a range of values for a single, central rod, fully inserted varying from slightly under 1% to about 1.5%

δk for all configurations considered. On the basis of the results of these calculations it appears that the most effective configuration is the one in which the rod thimble replaces the inner steel liner of the fuel element with the absorber element operating in a pool of moderator. The reactivity effect of the collapse of a dry rod thimble was found to depend upon the rod configuration involved. (W.L.H.)

2209 NAA-SR-Memo-3517
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
SURVEY OF ABSORBER MATERIALS SUITABLE FOR APPLICATION IN OMR PIQUA. J. A. Dudek. Jan. 20, 1959. 7p. OTS.

The feasibility of using presently available neutron absorber materials for operation in the OMR coolant stream was studied. (W.L.H.)

2210 NAA-SR-Memo-3650
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
RE-EVALUATION OF SHIELD REQUIREMENTS FOR OMR-PIQUA NEUTRON DETECTORS. D. S. Duncan. Mar. 17, 1959. 24p. OTS.

Due to major design changes made in the OMR-Piqua radial shield configuration a re-evaluation of shield requirements for the neutron detectors was made. A cylindrical lead—water shield is recommended. The relative thermal neutron flux at the detectors as a function of terphenyl density is shown. The heat generation rates in the lead shielding positioned in front and behind the detectors at full power operation are shown. The radiation level at the source range detector, as a function of time after shutdown following infinite operational periods, is given. (W.L.H.)

2211 NAA-SR-Memo-3665
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
PIQUA FUEL CLADDING FAILURE DETECTION SYSTEM—SAMPLING TUBE HEADER ANALYSIS. S. Yee. Mar. 23, 1959. 6p. OTS.

The leakage rate of organic coolant into the monitored channel from the remaining channels in the sample tube header configuration is determined. (W.L.H.)

2212 NAA-SR-Memo-3690
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
RADIAL HEAT GENERATION RATE AND BIOLOGICAL SHIELD THICKNESS FOR THE PIQUA OMR. D. S. Bost. Apr. 14, 1959. 18p. OTS.

The heat generation rate in the radial shield of the Piqua OMR was determined. Also determined was the radiation level at the outer surface of the biological shield as a function of shield thickness. (W.L.H.)

2213 NAA-SR-Memo-4190
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
SUMMARY OF THE INITIAL 1500 HOURS OF OPERATION FOR EXTENDED BOILING TEST NO. 6 WITH IRRADIATED OMRE COOLANT. D. A. Huber and J. L. Kortenhoeven. Aug. 13, 1959. 16p. OTS.

The objective of this investigation was to demonstrate the feasibility of operating organic cooled reactors for extended periods of time with irradiated coolant under conditions of nucleate boiling test No. 6 is still continuing and only the first 1500 hours of continuous operation is covered here. The over-all decrease in the heat transfer coefficient was 15 and 23.5% in the upper and lower test sections, respectively. Reduction of system pressure by bleeding gas from the surge tank had a detrimental effect on the value of the heat transfer coefficient due to either a temporary loss of flow, or a change in saturation characteristics, or a combination of both. A power failure of ~20 seconds duration had no permanent adverse effect on the value of the heat transfer coefficient. The test conditions for Boiling Test No. 6 are listed. (W.L.H.)

2214 NAA-SR-Memo-4266
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
PRELIMINARY GROSS NEUTRON FLUX DISTRIBUTION MEASUREMENTS IN THE OMR CRITICAL ASSEMBLY. R. J. Tuttle. Aug. 17, 1959. 7p. OTS.

A preliminary survey of gross flux distributions in the OMR critical assembly was made. Three flux measurements were made using the neutron-induced activity of Mn alloy wire. The flux distributions obtained are shown. (W.L.H.)

2215 NP-7969
Energie Nucléaire S. A., Lausanne, Switzerland.
RAPPORT INTERIMAIRE RELATIF AU PROJET DE CENTRALE NUCLÉAIRE DE 5 MWe. (Interim Report Relative to the 5 MW(E) Nuclear Power Station Project). Jan. 15, 1959. 33p.

The advanced planning and design of the Swiss 5 MW(E) nuclear power station was reported late in 1957. Since that time further study has led to some modifications in the design. The reactor characteristics which are established are reported, and the modifications which have been made are discussed. The principal design change is the addition of a double cycle and of a natural and forced circulation in the thermal cycles. The experimental program planned for the reactor is outlined, and the principal characteristics of the reactor are tabulated. The site selection is discussed, and the construction schedule is given. (J.S.R.)

2216 NPG-203
Nuclear Power Group, Chicago.
GRAPHITE MODERATED BOILING AND SUPERHEATING REACTOR SYSTEM (190,000 kw net electric). June 15, 1959. 151p.

The preliminary design of the graphite moderated boiling and superheating reactor system is presented. The design utilizes the high efficiency and known technology of high pressure and temperature steam cycles for the conventional portion of the plant. The nuclear plant consists of a circular cylindrical core with fuel elements of 2% enriched UO_2 in a graphite matrix. The reactor is safe in that it will become subcritical on loss of coolant and has a negative temperature coefficient of reactivity. Plant capital cost is estimated at $41,672,000, or $219 per net electrical kilowatt. (W.L.H.)

2217 ORNL-1177(Del.)
Nuclear Development Associates, Inc., White Plains, N. Y.
THE SUPERCRITICAL WATER REACTOR. A Report to Oak Ridge National Laboratory. Feb. 1, 1952. Decl. with deletions Sept. 21, 1959. 129p. Contract AT(40-1)-1065, Subcontract 394 to W-7405-eng-26. OTS.

A study on the Supercritical Water Reactor and shield is presented. The reactor consists of a structure of stainless steel plates immersed in a vessel of water which is above the critical pressure. The plates contain the fuel and provide a heat transfer surface. The water serves as coolant, moderator, reflector, shield, and some reactivity control. The heat output 400 Mw appears attainable with a reactor having a modest size core (2.5 ft^2 cylinder) and a reasonable fuel inventory (20 kg). (W.D.M.)

2218 ORNL-1215
Oak Ridge National Lab., Tenn.
HEAT TRANSFER AND PRESSURE LOSS IN TUBE BUNDLES FOR HIGH PERFORMANCE HEAT EXCHANGERS AND FUEL ELEMENTS. G. H. Cohen, A. P. Fraas, and M. E. LaVerne. Aug. 12, 1952. Decl. Oct. 9, 1959. 75p. Contract W-7405-eng-26. OTS.

A promising type of construction for both heat exchangers and fuel elements involves parallel flow through bundles of closely-spaced tubes. This report discusses problems encountered in spacing long slender tubes and in handling the cross-flow regions at the ends. A series of model tests, planned to give the more important pressure-drop and heat-transfer information required for ANP design work, are reported. Two heat-exchanger models and three ARE-type fuel-element bundles were flow-tested with water and air, and the heat-transfer characteristics of one heat-exchanger model were determined with NaK. Appendixes include the following: cooling effectiveness and overall heat-transfer coefficient; friction factor and Reynolds' number for air-flow and water-flow tests; correlation of flow through individual tubes with tube length and diameter; and metallographic examination of heat exchanger after 3000 hr operation in NaK. (L.T.W.)

2219 ORNL-2113
Oak Ridge National Lab., Tenn.
BASIC GAMMA-RAY DATA FOR ART HEAT DEPOSITION CALCULATIONS. H. W. Bertini, C. M. Copenhaver, A. M. Perry, and R. B. Stevenson. Oct. 3, 1956. Decl. Oct. 9, 1959. 76p. Contract W-7405-eng-26. OTS.

Heat deposition rates from gamma rays in the ART were required for thermal stress calculations. The basic physical data necessary in determining these rates are reported. U^{235} prompt gamma rays, capture and decay gammas in the fuel and reflector, and gamma rays from inelastic scattering of neutrons are included. Buildup factors and absorption coefficients are considered. The multigroup intervals used for determining neutron fluxes for capture and inelastic scattering calculations are given. (D.E.B.)

2220 ORNL-2442
Oak Ridge National Lab., Tenn.
THERMAL STRESS ANALYSIS OF THE ART HEAT EXCHANGER CHANNELS AND HEADER PIPES. D. L. Platus. Apr. 2, 1958. Decl. Oct. 9, 1959. 38p. Contract W-7405-eng-26. OTS.

The stresses, deflections, and the forces and moments acting on the Aircraft Reactor Test heat exchanger channels and header pipes due to relative thermal expansion between the channels and pressure shell at full power operation are summarized. (auth)

2221 ORNL-2703(Del.)
Oak Ridge National Lab., Tenn.
ARMY PACKAGE POWER REACTOR PROJECT PROGRESS REPORT [FOR 1958]. Apr. 6, 1959. Decl. with deletions Sept. 16, 1959. 90p. Contract W-7405-eng-26. OTS.

Investigations were conducted on replacing type 347 stainless steel for 304B and 304L as matrix and cladding material in APPR-core 1. The Haynes-25 combs used as flux suppressors in the control rods of core 1 contributed to the high cobalt activity of the system, and therefore dispersions of Eu_2O_3 in stainless steel were developed for use as flux suppressors in core II. In an effort to provide for operation of core II with a bank of five control rods rather than seven as in core I, means were studied for increasing the boron concentration in the fuel plates. Irradiation tests of fuel plates in the MTR failed to indicate any radiation damage to the specimens even for U^{235} burnup as high as 57%. Methods were developed for fabricating absorber sections for the control rods that consisted of a type 304 stainless steel clad dispersion of 2.86 wt. % B^{10} in electrolytic iron. The absorber section developed for core II consists of a roll-clad stainless steel composite plate containing a dispersion of 38 wt. % Eu_2O_3 in stainless steel. Experiments were performed in which irradiated fuel plates were melted under controlled conditions simulating the loss-of-coolant accident. A review was made of the critical experiments performed in connection with the APPR-1. Under the Gas Cooled Reactor Program a gas-cooled loop was designed for in-pile testing of advanced fuel specimens in two adjacent lattice positions in the ORR. (W.D.M.)

2222 PRDC-TR-25
Power Reactor Development Co., Detroit.
MONTHLY TECHNICAL REPORT [FOR] PERIOD JULY 1959. 27p. Contract AT(11-1)-476. OTS.

Progress in core design, materials, nuclear engineering, reactor vessel engineering, mechanical handling, electrical and instrumentation, liquid metal and steam systems, and test operations are summarized. Environmental radioactivity reports for the Enrico Fermi Reactor are included. (For preceding period see PRDC-TR-24.) (W.L.H.)

2223 PRDC-TR-26
Power Reactor Development Co., Detroit.
MONTHLY TECHNICAL REPORT [FOR] PERIOD AUGUST 1959. 28p. Contract AT(11-1)-476. OTS.

Progress in core design, materials, nuclear engineering, reactor vessel engineering, mechanical handling, electrical and instrumentation, liquid metal and steam systems, and test operations are summarized. Environmental radioactivity reports for the Enrico Fermi Reactor are included. (For preceding period see PRDC-TR-25.) (W.L.H.)

2224 SRIA-4
Stanford Research Inst., Menlo Park, Calif.
DEVELOPMENT OF TRAINING PROGRAMS FOR OPERATING AND MAINTENANCE PERSONNEL IN NUCLEAR POWER GENERATION SYSTEMS. Howard M. Vollmer. Feb. 1959. 76p. SRI Project No. IU-2588. OTS.

The objectives of the study were to analyze training requirements for operating and maintenance personnel in nuclear power generation systems, to prepare a detailed outline of an introductory training course on nuclear energy and power plant applications, and to prepare general descriptions of more-advanced curricula to meet the training requirements of nuclear power plant personnel. Data on training requirements and programs were collected from major utility companies, agencies, and installations where nuclear power plants are in operation or being planned. It was concluded that definable needs exist for special training of operating and maintenance personnel in nuclear power generation systems. It was concluded also that a training course entitled "Survey of Nuclear Energy and Power Plant Applications," along with certain suggestions for more-advanced curricula, would initially meet these training needs within the context of management-, union-, or school-sponsored training programs. Suggestions for further research included: an investigation of the usefulness of course material already provided in the introductory course, with a view toward making improvements in future presentations; a study of the special needs of workers in a variety of industries affected by nuclear energy technology, so that more-advanced curricula may be designed to meet their varying requirements; and research on implications of nuclear energy technology upon job structure, career development, attitudes toward work, and other aspects of work experience. (auth)

2225 TID-8515
Division of Reactor Development. Civilian Reactors Evaluation and Planning Branch, AEC.
REPORT OF THE SODIUM HEAVY WATER REACTOR TASK FORCE. May 1959. 39p. OTS.

The sodium–heavy-water reactor concept was evaluated on the basis of (1) its technical feasibility and (2) its potential for the economical production of electric power. Problems such as operational criticality and integrity of fuel assemblies will have to be resolved before the concept can be considered technically feasible. In addition, the costs associated with the fuel cycle and the sodium-to-steam equipment will have to undergo substantial reductions before this concept can compete with other natural-uranium systems. (auth)

2226 WAPD-PWR-(RD-1)-283
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
PWR CORE 1 SEED 2 STRESS ANALYSIS. F. V. Naugle. Aug. 1958. 27p. Contract-11-1-GEN-14. OTS.

The results of the first phase of the Seed-2 photoelastic study are reported. The purpose of this phase was the determination of the peak stress in the subassembly under simulated pressure and thermal loading. An evaluation of the Seed-2 cluster design on the basis of both yield strength criterion and the more appropriate fatigue criterion is reported. (W.L.H.)

2227 WAPD-T-413
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
THE PWR REACTOR VESSEL. P. A. Halpine. Jan. 1957. 18p. Contract AT-11-1-GEN-14. OTS.

The design and the design problems associated with the PWR reactor vessel are described. The vessel was designed to the following parameters: design pressure-2,500 psi; normal operating pressure-2,000 psi at the reactor outlet; design temperature-600°F; and leakage-designed for zero leakage. The major portion of the vessel is fabricated from carbon steel Type SA-264, clad with A1S1-30P stainless steel. The vessel shell consists principally of three major portions: the bolting flange, cylindrical section, and bottom hemispherical head. (W.L.H.)

2228 AEC-tr-3620
SEMI-HOMOGENEOUS HIGH-TEMPERATURE GAS-COOLED BREEDER REACTORS. K. Inoue, T. Kuroyanagi, and S. Yajima. Translated from a publication of the Japanese Atomic Energy Research Inst., Tokyo, 1958. 90p. OTS.

An attempt is made to economically evaluate a semi-homogeneous high-temperature gas cooled reactor. The reactor is discussed in terms of the materials, physics, and heat exchange. The fission products in the graphite and reprocessing of the fuel are considered. (W.D.M.)

2229
THE DEGREE OF BURN-UP IN A NUCLEAR REACTOR. Ragnar Liljeblad (Asea, Västerås, Sweden). Asea Research No. 2, 115-22(1959).

Burn-up of fissile material from homogeneous and heterogeneous reactors with conversion ratios greater and less than unity are treated relative to the effects of the main parameter and the number of fissile nuclei available. The possibilities of improving burn-up by recycling extracted plutonium are examined. (auth)

2230
NEW ASPECTS IN THE PRODUCTION OF GREAT NUCLEAR POWER REACTORS. Josef Hauer (Zavody V. I. Lenina, Plzeň, Czechoslovakia). Jaderná energie 5, 289-95(1959). (In Czech.).

The problems of manufacturing pressure vessels, which are a substantial part of many power reactors are summarized. The paper is based on experience gained in designing and constructing nuclear power reactors. (auth)

2231
TRAWSFYNYDD. NUCLEAR POWER STATION. I. ENGINEERING DESIGN. J. W. Ashley (Atomic Power Constructions, Ltd., London). 2. TECHNICAL CALCULATIONS. S. A. Young (Atomic Power Constructions, Ltd., London). 3. CIVIL ENGINEERING. D. H. New (Atomic Power Constructions, Ltd., London). Nuclear Power 4, No. 43, 90-9(1959) Nov.

Now under construction at Trawsfynydd in North Wales, this 500 Mw nuclear power station is the first plant to be sited inland and presents many interesting problems. Design and description are given for the core, pressure vessel, fuel elements, charge–discharge, reactivity control, boilers, gas flow, turbogenerators, and station control. Calculations and civil engineering are reviewed. Principal station data and a 36 × 24 in. colored wall chart are given. (W.D.M.)

2232
THE PERFORMANCE OF NUCLEAR ROCKETS. O. H. Wyatt (Hawker Siddeley Nuclear Power Co., Ltd., Langley, Eng.). Nuclear Power 4, No. 43, 100-3(1959) Nov.

Comparison of future chemical and nuclear rockets shows that hydrogen-propelled graphite reactors may offer distinct advantages, especially for larger payloads. Graphite moderated reactors with maximum propellant temperatures around 2000°C are considered. Burn-out velocity, propellant, reactor types, heat transfer, weight analysis, rocket performance, design optimization, radiation hazards, and comparative chemical rockets are discussed. (W.D.M.)

2233
SIMULATION OF THE THERMAL EXCHANGE IN A NUCLEAR POWER PLANT OF THE PWR TYPE. Monteraldo Schiavon, Giorgio Saldaini, and Vito Svelto. Strumentazione e Automazione, No. 4, 153-7(1959) Apr. (In Italian)

A brief description is given of the reactor simulator. The problem of thermal exchange in the reactor core is then considered. The equations for the heat transmission in the fuel elements and between fuel element and primary coolant are given. A network which simulates these equations is derived. The problem of heat transfer between the primary and secondary circuits is also considered. A network which simulates the heat exchanger and the transport of coolant between reactor and exchanger is investigated. (tr-auth)

2234
A SYSTEM OF ROCKET PROPULSION USING REACTORS AND GAS TURBINES. J. Ackeret (Swiss Federal Inst. of Tech. (Eidgenössische Technische Hochschule, Zurich). p. 277-81 of "IXth International Astronautical Congress, Amsterdam, 1958, Proceedings. [Vol.] I." F. Hecht, ed. Vienna, Springer-Verlag, 1959. p.1-506.

The large pressure ratio between a fluid medium and its gaseous state (after expansion into the vacuum) can be partially utilized to produce work by isothermal expansion with the aid of nuclear reactors and gas turbines. This energy, if returned in electrical form (arc heating) to the gas before the ultimate expansion, produces higher jet velocities. (auth)

2235

FISSION THERMAL POWER PLANTS. J. J. Barré (Fabrication d'Armement, Versailles, France). p. 333-42 of "IXth International Astronautical Congress, Amsterdam, 1958, Proceedings. [Vol.] I." F. Hecht, ed. Vienna, Springer-Verlag, 1959. p.1-506. (In French)

Having emphasized the importance of the thrust per mass and indicated that this factor is one of the weak points of fission-thermal power plants, it is shown that resorting to an opaque expellant would permit the realization of heat transfer by convection plus radiation which would magnify the power ten times and enhance the thrust without any weight penalty. A numerical example serves to verify the anticipated gain. (auth)

2236

IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. William Frank Wood (to United Kingdom Atomic Energy Authority). British Patent 821,607. Oct. 14, 1959.

A reactor design using spherical refractory fuel and moderator pellets, gas-cooled, is described. The outer shell of metal and/or refractory construction is set in concrete, and it has openings for admitting coolant, admitting core vessel, and loading and unloading reflector pellets. Coolant gas flows up through reflector and down through core. The refractories may be BeO. Fertile material may be incorporated for breeding. (T.R.H.)

2237

IMPROVEMENTS RELATING TO REACTORS. (to General Electric Co.). British Patent 822,032. Oct. 21, 1959.

A boiling-water reactor either homogeneous or heterogeneous, is described which is controlled by vapor formation, and heat energy can be removed from non-boiling liquid portions of the reactor. (T.R.H.)

2238

IMPROVEMENTS IN HETEROGENEOUS NUCLEAR REACTORS. (to Allmänna Svenska Elektriska AB). British Patent 822,220. Oct. 21, 1959.

A fuel element is described which offers the possibility of using Mg in its construction. Fuel rod bundles are supported in a can which is surrounded by another can, the space between being filled with stagnant coolant as thermal insulation. Coolant gas flows down in the reactor outside these cans and back up through the inner can around the fuel rods. The pipe separating coolant gas from heavy water moderator can be made of Mg taking advantage of its nuclear and corrosion properties. (T.R.H.)

Production Reactors

2239

IMPROVEMENTS IN OR RELATING TO TWO ZONE BREEDER NUCLEAR REACTORS. Ronald George Tongue (to United Kingdom Atomic Energy Authority). British Patent 822,356. Oct. 21, 1959.

A reactor arrangement is described in which a two-zone breeder is characterized by having a blanket liquid at a lower pressure than the core liquid at the same temperature. Thus, if the core is self-supporting with regard to internal pressure, then the blanket vessel may be built to withstand the reduced blanket pressure. This simplifies construction and cost. (T.R.H.)

WASTE DISPOSAL AND PROCESSING

2240 HW-42408(Del.)

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

CHEMISTRY OF THE "SILVER REACTOR." PART A. INFLUENCE OF NO_2 CONCENTRATION AND TEMPERATURE DURING SLUG DISSOLVING. G. B. Barton. PART B. REACTIONS WITH AMMONIA GAS. E. D. McClanahan, Jr. Mar. 5, 1956. Decl. with deletions June 11, 1959. 15p. OTS.

A study was conducted to improve the efficiency of iodine removal from chemical processing waste gases. The investigation revealed that no single chemical equation expresses the reaction of silver nitrate with iodine in the presence of various compositions of air—nitrogen—oxygen systems under varied conditions. A study was also made on the effects of coating removal gases such as ammonia on the silver reactor. Observations on conditions under which absorbed iodine may be released due to the presence of ammonia are included as well as a discussion of chemical aspects of ammonia reactions. It was concluded that the silver nitrate reactor will not reduce the iodine concentration in plant gas streams to the level required by future needs. It is noted that the investigations were halted before completion. (J.R.D.)

2241 HW-60584

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

RESEARCH AND DEVELOPMENT ACTIVITIES, RADIOACTIVE WASTE FIXATION. Quarterly Progress Report, January—March 1959. D. W. Pearce, ed. Apr. 15, 1959. 14p. Contract W-31-109-Eng-52. OTS.

A semiworks waste calcination prototype is being constructed to develop knowledge of engineering design and operational parameters. Some of the ultimate waste storage schemes presently being considered involve the storage of calcined waste as powders. Studies were initiated in experimental equipment to provide information on the heat transfer characteristics of such a self-heating system. Radiant-heat spray calcination is being studied for calcination of high-level radioactive wastes. The fixation of radioactive wastes by mineral reactions is being studied. (W.L.H.)

2242 IEA-4

São Paulo, Brazil. Universidade. Instituto de Energia Atômica.

RECOVERY OF CESIUM-137 FROM FISSION PRODUCTS IN WASTES OF NUCLEAR REACTOR INSTALLATIONS. (Recuperacão do Cêsio-137 dos Resíduos de Fissão em Instalacões Nucleares). Fausto W. Lima, Alcidio Abrão, and Constancia Pagano. July 1959. 14p.

A process for the recovery of Cs^{137} from fission product wastes is described. The process is based on the entrainment of cesium by alum, and it differs from the usual procedures in that the alum crystallization is carried out in alcoholic medium. It is, therefore, unnecessary to heat the solution and then to cool it for the alum crystallization. Decontamination factors of up to 10^6 are attained in a single co-crystallization, which is carried out in a very simple operation. Six times less alum is used than in the procedure where it is necessary to heat the solution. (auth)

2243 NAA-SR-Memo-3005

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

RADIOACTIVE WASTE PRODUCTION AND DISPOSAL—

PIQUA. A. Piccot and J. Wooldridge. Aug. 20, 1958. 17p. OTS.

Studies were made to determine the volumes and levels of radioactivity in the routine high boiler residue wastes produced at Piqua and to investigate various methods and costs of storing or disposing of these wastes. (W.L.H.)

2244

USE OF THE DIFFUSION EQUATION IN THE DESIGN OF THE SMOKE STACK OF A REACTOR. Tibor Hoffmann and Geza Nemeth. Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének Közlemenyei 5, 582-8(1958). (Translated from Referat. Zhur. Fiz. No. 5, 1959, Abstract No. 10276).

Calculations based on simple diffusion theory are presented in which the concentration of radioactive mixtures, leaving a stack with a specified height (taking into account the decay) are estimated. The calculations were carried out for aerosols and for a gas in the presence of horizontal wind, and without it. The calculations can be used in the design of reactors.

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